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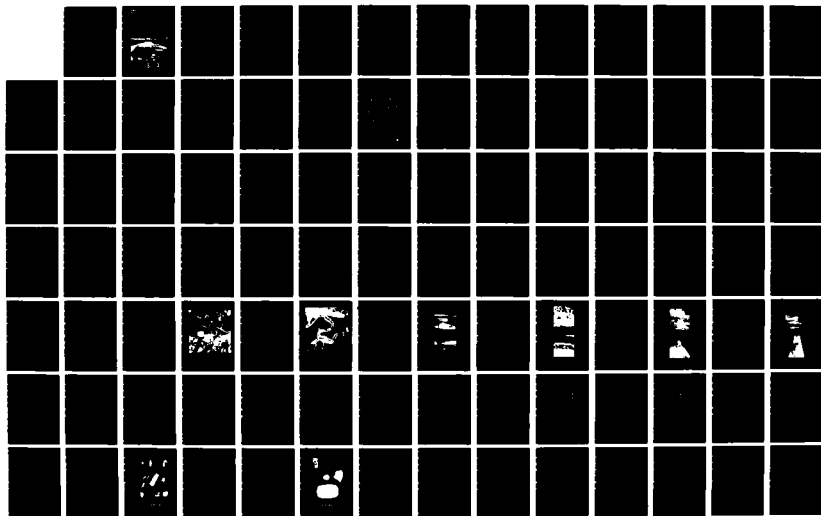
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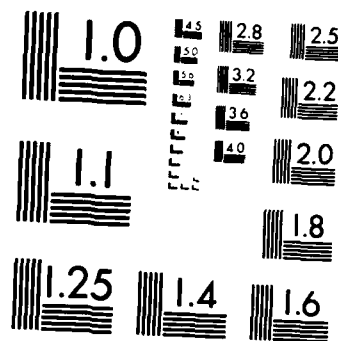
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US Army Corps
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Melvorn Lake, Kansas

Archeology Department
Kansas State Historical Society

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Archeological Investigations At the Cow-Killer Site, 140S347

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By John D. Reynolds

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ARCHEOLOGICAL INVESTIGATIONS AT THE
COW-KILLER SITE, 140S347, MELVERN LAKE, KANSAS, 1974-1975

by

John D. Reynolds
Archeology Department
Kansas State Historical Society



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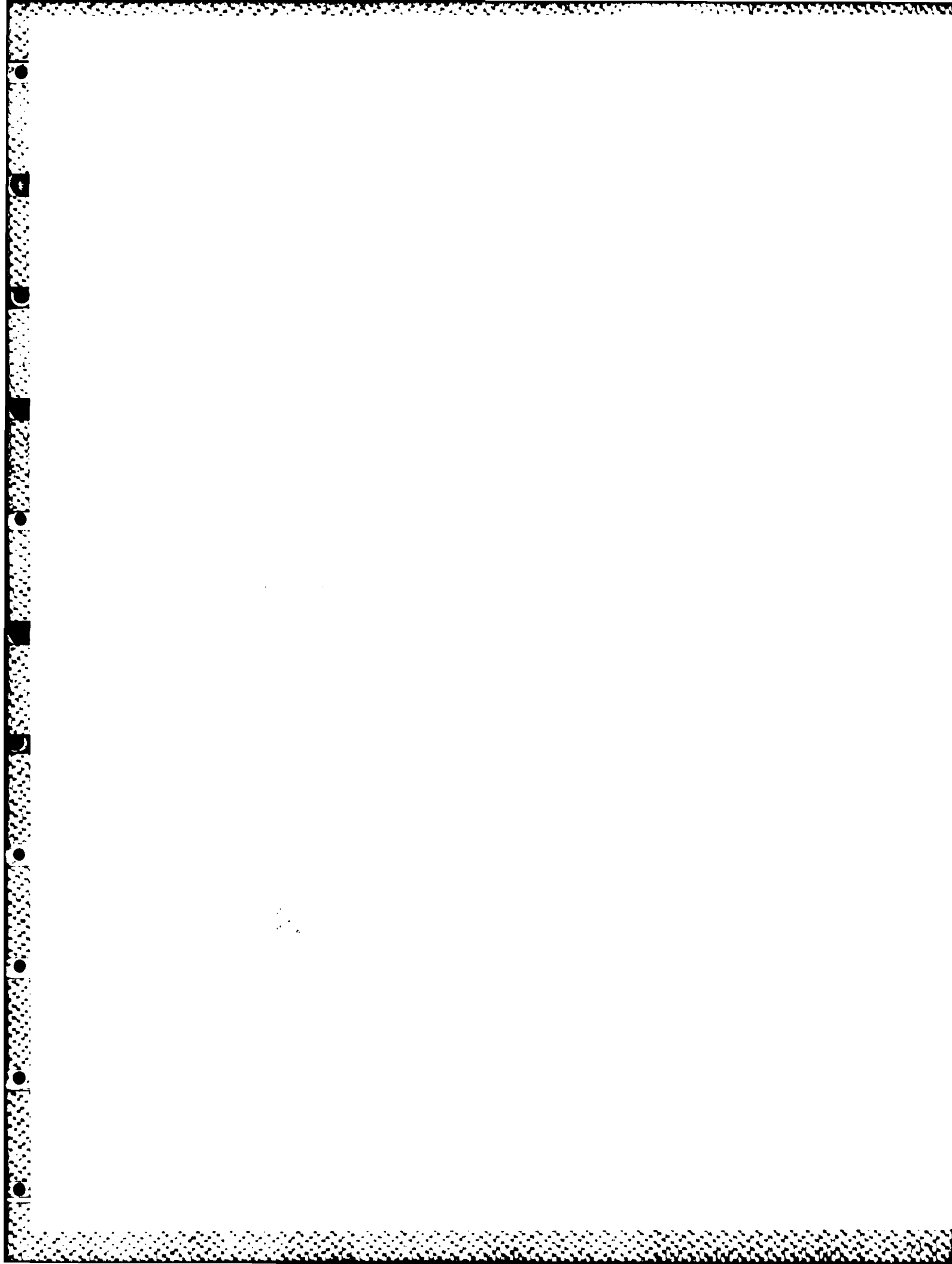
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ABSTRACT

Archeological site 140S347, the Cow-Killer site, is an important multicomponent prehistoric archeological site that was discovered during removal of fill from a highway borrow area in conjunction with the realignment of highway U.S. 75 in Osage county, Kansas. The site is located on the left or noth side of the Marais des Cygnes river on U.S. Army Corps of Engineer land just downstream from Melvern dam. Cultural materials attributable to at least three temporally distinct prehistoric cultures have been identified in the site area. The earliest cultural level represented is an Archaic period component that was buried 9 to 12½ ft below the original ground surface. Test excavations performed in this deposit revealed the presence of a stratified level which yielded stone lined fire hearths, basin-shaped and trash-filled pits, postmolds, chipped and ground stone tools, animal bone, stone debitage, charcoal, a few charred seeds and burned earth. On the basis of distinctive chipped stone bifaces and points, an affiliation with the Munkers Creek phase is suggested. A date of circa 3,000 B.C. is suggested.

The second oldest cultural zone recognized, and the focus of this report, is a stratified Plains Woodland component of the Greenwood phase which is dated within the latter part of the Early Ceramic period. This component occurred 3 to 6 ft below the original ground surface, and it was extensively tested during the spring of 1975 in an area where the U.S. Army Corps of Engineers was constructing sewer facilities. Structural remains encountered included postmolds, pits, hearths, basins and trash deposits. Artifacts recovered included potsherds, large to small stemmed projectile points, bifaces, unifaces, lithic debitage, ground and pecked stone tools, worked and unworked bone and antler, mussel shells, charcoal, burned daub, a few burned seeds and nut shells, and burned earth. A suggested age is from A.D. 500 to A.D. 1000.

Evidence for the presence of a third and more recent cultural component was found within the disturbed top soil of the site where materials identified as attributable to the Middle Ceramic period (A.D. 1000 to A.D. 1500) were encountered. Diagnostic ceramics suggest a Pomona focus cultural attribution for this cultural level.

Though subjected to considerable damage connected with highway and reservoir construction projects, the Cow-Killer site still contains a significant intact remnant of the Archaic component as well as possible Greenwood phase and Pomona focus deposits.

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FOREWORD

A number of individuals and institutions deserve special recognition for their part in the 1974 and 1975 investigations of archeological site 140S347, the Cow-Killer site. The 1975 investigations in Area 751 of the site were funded by the U.S. Army Corps of Engineers, Kansas City District under auspices of Purchase Order DACW41-75-M-0777. The field investigations conducted during 1974 in the highway borrow area at site 140S347 were funded jointly by the Kansas Department of Transportation and the Kansas State Historical Society under provisions of the Cooperative Agreement for Highway Archeological Salvage program for Kansas. Thomas A. Witty, Jr., State Archeologist of Kansas, served as project director throughout these investigations and he provided invaluable direction, advice, and assistance throughout the investigation and subsequently during the analysis and report preparation.

Individuals from both state and federal institutions contributed valuable information and advice. Frank Heck, State Highway Inspector and Kenneth Foth, State Highway District Engineer, are the individuals who were responsible for recognizing the potential importance of the site and protecting it from further destruction until the Archeology Department of the Kansas State Historical Society could perform evaluative testing. The Melvern lake resident engineer and the Melvern lake construction engineer spent long hours in consultation with archeologists from the Historical Society and their cooperation was certainly appreciated. U.S. Army Corps of Engineers personnel early recognized the uniqueness of the cultural deposits at the Cow-Killer site and aided us in numerous ways in preserving and mitigating the site.

A special thanks must be given to the crew that conducted the actual investigations. Ernest E. Carr, of Independence, Kansas, was a most capable foreman. His stamina, experience, perserverance, and loyalty were much appreciated. The investigations conducted at the Cow-Killer site apparently occurred at a formative time for a number of individuals. It was my good fortune to have on my crew a number of individuals who added materially to the success of the dig and who have, since that time, proved their dedication to archeology. Among these are my good friends Randall M. Thies, currently an archeologist at the Kansas State Historical Society; Rozalyn McLelland, Librarian/Historian of the Kansas Anthropological Association; Dianna Rogers, past president of the Kansas Anthropological Association; and Marilyn Bailey who is currently pursuing a

graduate degree in anthropology. Other crew members deserving a special thanks are John Suttan, Pam Moore, Anthony Cutright, David L. Miller, Amy Hill, David Hays, Loren Lewis and Phil Aiken. John Suttan, in particular, was of invaluable assistance during both the 1974 and 1975 investigations.

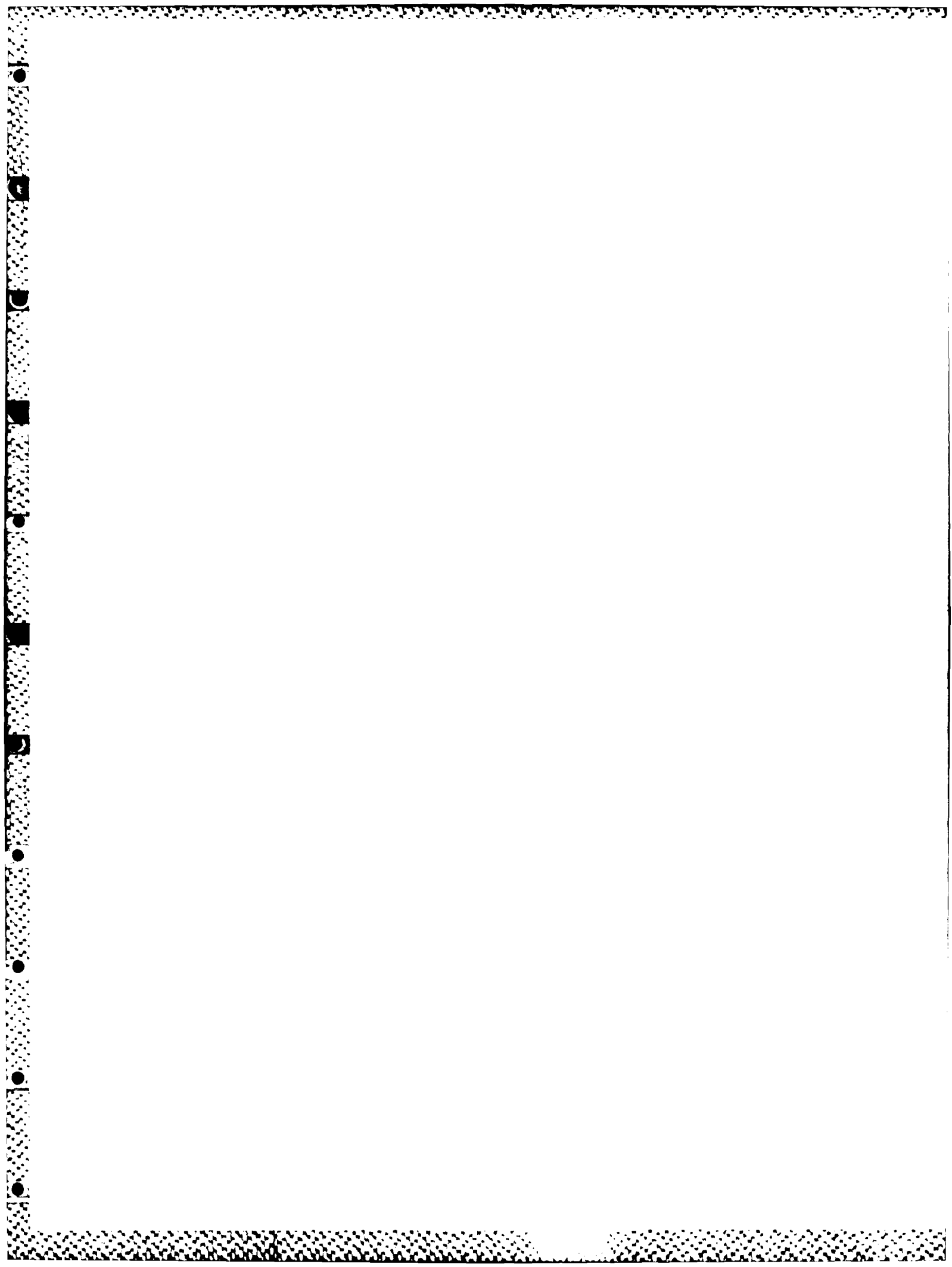
Members of the Kansas Anthropological Association cheerfully and expertly aided the author in testing the site during the fall of 1974. Included in this list are Virginia Reynolds, Joe Bailey, Mark McLelland, Neil Rogers, Harold Reed, Margie Reed, Duane Kusy, Fern Kusy, Mary Andrews, Chuck Andrews, Dr. Clark, Tod Schaefer and Mitch Murphy.

My colleagues at the Kansas State Historical Society have aided me in numerous ways in completing this report. Belinda Neal, expert typist and formidable editor, has given unstintingly of her time and expertise. Barbara Tibbitts has capably shared these responsibilities with Belinda. Randall M. Thies, Virginia Reynolds and Terry Johnson all assisted in cataloguing and identifying the materials recovered from the Cow-Killer site. Caryl Wood identified most of the faunal remains from the site. Thomas A. Witty, Jr. and Thomas P. Barr both aided the author considerably during the early testing of the site and in the later excavation and analysis. Kenneth Ashworth prepared several of the finished illustrations and William T. Brogan aided considerably in the analysis and presentation of the ceramics. Don Rowlison proved to be a helpful critic and advisor. Earl Kintner, Society photographer, devoted considerable time to photographing specimens and giving expert advice.

I would also like to thank my wife Ginger and my sons Jesse and Logan for all of their help and support.

On the first day that it was visited by a professional archeologist, the archeological site that is the concern of this report was officially designated as site 140S347 following the trinomial method of site designation proposed by the Smithsonian Institution, River Basin Survey. This is the scientific method for designating all archeological sites in Kansas and its usage is employed by the Kansas Antiquities Commission, as well as by archeologists at the Kansas State Historical Society, the University of Kansas, Kansas State University and Wichita State University. Perversely, the scientist who has the responsibility for excavating, recording, and reporting upon the succeeding investigations of particular archeological sites, invariably renames the sites with appropriate (or inappropriate) uncommon names. This is precisely how the Cow-Killer site, 140S347, got its peculiar name. While monitoring highway borrow removal on the second day of the site investigations, the author noted a

very fleet-footed Cow-Killer fleeing from the construction equipment. Immediately, the site was named with a much more memorable epithet than 140S347. A Cow-Killer, incidentally, is a fossorial (adapted to digging) wasp of the family *Mutillidae*. Cow-Killer wasps are also sometimes referred to as hairy wasps or velvet ants (the females are wingless, have a severe sting, and look like very large and multicolored ants). These wasps are parasitic on other wasps and insects. The female burrows into the ground and lays her eggs in the carcasses of recently fallen prey.



INTRODUCTION

The Cow-Killer site, 14OS347, is a multicomponent prehistoric archeological site which is located in the south central portion of Osage county, Kansas, 33 miles south of Topeka. The site is situated on an old terrace on the north or left side of the Marais des Cygnes river and it is located just downstream from the axis of the Melvern lake dam on land owned by the United States Army, Corps of Engineers.

The site was discovered during removal of fill from a state purchased borrow area in conjunction with the realignment of highway U.S. 75. Alert construction personnel had noted the occurrence of complexes of burned stone and bone in the construction cuts and informed the appropriate Kansas Department of Transportation officials of these finds. These individuals immediately contacted the Archeology Department of the Kansas State Historical Society and informed us of the finds. Appropriate Emergency Salvage investigations were immediately undertaken by the Society under the auspices of the Cooperative Agreement for Highway Archeological Salvage program for Kansas. Full time monitoring of fill removal proceeded from this time and, when potentially significant materials were exposed, a larger scale Emergency Salvage investigation was undertaken to establish the nature and significance of the exposed remains. These investigations, conducted over a three-week period in late summer and early fall of 1974, demonstrated that site 14OS347 was a three component site which contained archeological components and materials related to Archaic, Early Ceramic, and Middle Ceramic cultural manifestations. A significant intact remnant of the Archaic component was successfully isolated from further destruction as a direct result of these tests.

While monitoring of the borrow removal was taking place, Society archeologists discovered that another construction project was being undertaken in the vicinity of site 14OS347. This project consisted of the construction of two sewage stabilization ponds at the southwest edge of site 14OS347 by the Kansas City District, Corps of Engineers. The sewage facility was being constructed in conjunction with Melvern lake construction and operation. Monitoring of this area on an informal basis by Society archeologists was conducted during the late summer of 1974. The presence of a buried cultural zone of some complexity and richness was noted and the Kansas City District, Corps of Engineers was informed of these findings. Subsequently, the Kansas State Historical Society entered into a purchase order with the Kansas City District, Corps of Engineers to conduct archeological salvage investigations of extant portions of this buried zone that were contained within a 70 by 150 ft wide dike that separated the two already constructed stabilization ponds. These salvage investigations were conducted by a Society archeological crew during April and May of 1975.

Thomas A. Witty, Jr. was the project director and John D. Reynolds was in charge of the field investigations. Upon completion of the investigations, a brief report of the findings was submitted to the Kansas City District, Corps of Engineers, with the understanding that a more complete analysis of the investigations would be funded at a later time.

On February 4, 1977, the Kansas State Historical Society and the Corps of Engineers, Kansas City District formalized a purchase order (DACW41-77-M-0532) for a final report (including cataloguing of specimens, analysis, etc.) on the investigations undertaken by the Society during the spring of 1975. Difficulties with the scope of work, and prior commitments of the Society for other archeological projects, have delayed this report completion until the present time.

The focus of the 1975 investigations at the Cow-Killer site was in the area of the Corps of Engineers stabilization ponds (Area 751). In this area, a series of cultural strata were observed. The focus of the 1975 work was on the best preserved of these deposits; a 2 ft thick cultural zone which is attributable to the Greenwood phase of the Plains Woodland variety of the Early Ceramic period in Kansas. Structural elements, artifacts, subsistence data and stratigraphic relationships were discovered intact in the central dike area of the stabilization ponds which provide important data for our understanding of this cultural manifestation. The present report provides a description of the findings of the investigations in Area 751 and also relates these findings to the previous investigations that were conducted at the Cow-Killer site.

All of the records, maps, photographs and specimens recovered during the Society investigations at the Cow-Killer site are presently curated at the Kansas State Historical Society building in Topeka.

THE ENVIRONMENTAL SETTING

Physiographically, the Melvern lake area is located in the Osage Cuestas, a division of the Osage Plains section of the Central Lowlands province of the Interior Plains physiographic division of North America (Fenneman 1957, Schoewe 1949, Wilson 1978; Figure 1). The Flint Hills Upland, another major division of the Osage Plains, lies approximately 30 miles to the west of the lake area and the southern border of the Dissected Till Plains lies approximately 40 miles north.

The Osage Cuestas region is an area of relatively low relief with a flat landscape relieved by the presence of long, low, easterly facing escarpments, or cuestas, which were formed by the exposure and subsequent erosion at the ground surface of alternating beds of limestone, shale, and sandstone (Schoewe 1949). The strata dip gently to the west and northwest and form a series of parallel ridges having gently sloping west faces and steeply sloping east faces (Schoewe 1949). The topographic setting is thus one of long, low, rolling hills and wide, shallow valleys.

Outcropping rocks in Osage county range in age from Pennsylvanian to Quaternary and are all of sedimentary origin (O'Connor 1955:6). The Quaternary deposits in Osage county are predominantly fluvial deposits. Pleistocene and recent alluvium, consisting of stream laid gravel, sand, silt and clay, occur in the stream valleys and constitute the flood plains of the valleys with thicknesses of 40 ft noted for portions of the Marais des Cygnes valley (O'Connor 1955:6). "Loess and colluvial silt deposits occur as discontinuous and thin veneers along the valley slopes and some of the upland flats..." (O'Connor 1955:6).

As O'Connor, et. al, (1955) and Reid (1980:2) have noted, Osage county lies in the southwestern part of the Forest City Basin, a significant spatial unit of the Pennsylvanian limestone and shales in northeastern Kansas that have been divided into the Missourian and Virgilian series. The Virgilian series is represented in Osage county by a number of limestones and shales attributable to the Shawnee group (O'Connor et. al 1955; Table 1). The Shawnee group includes both Topeka limestone and Plattsmouth limestone, as well as Deercreek limestone, all of which contain at least some chert inclusions (O'Connor et. al 1955; Table 1). Reid notes that exposures of natural outcrops of Shawnee group cherty limestones occur in Osage county, Kansas (Reid 1980:5). Reid further notes that:

The Shawnee group cherts are much more homogeneous in terms of color and fossil inclusions than those of the Missourian

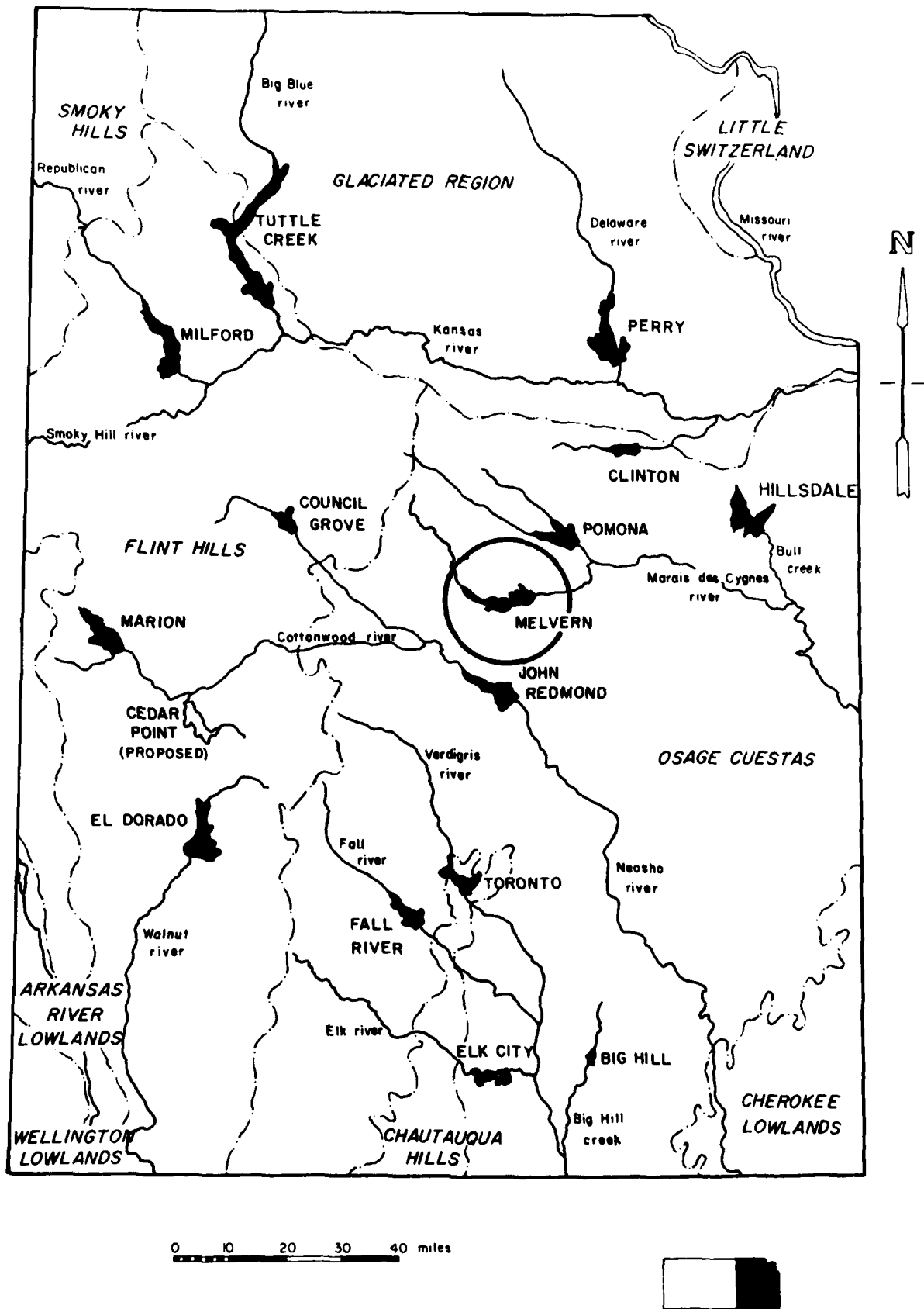


FIGURE 1: Melvern lake and related areas in eastern Kansas

series, and are easily confused with one another. There appears to be as much variability within facies of the same member as there is between different members. However, as a group, they tend to be gray to dark in color, and highly fossiliferous. The most common fossils are fusilinids and crinoid columnals, typically replaced and highlighted by white calcite (Reid 1980:5).

O'Connor et. al also note the extensive deposits of cherty gravels that occur in terraces of Kansan age and older deposits as well as in alluvium and low terrace deposits (1955:24).

Mineral resources of Osage county include coal, limestone, sandstone, shale, sand and gravel, silt, and clay (O'Connor et. al 1955:20). Several of these mineral resources, particularly limestone and coal, have been exploited during the recent historic period. Tests conducted on shales (O'Connor et. al 1955:22) indicate that the shales of Osage county are suitable for the production of heavy clay products such as brick, tile blocks, quarry tile, and drain tile (O'Connor et. al 1955:22). O'Connor further notes that most of the shales contain enough silt or sand to make them somewhat lean or short (O'Connor et. al 1955:22). Such lean or short clays are advantageous for some ceramic processes as they allow for rapid drying without danger of cracking or warping (O'Connor et. al 1955:22).

The soils of Osage county are mainly of residual origin (formed in place by weathering of underlying bedrock) and alluvial origin (deposited by stream action). Remnants of glacial deposition occur in the northern part of Osage county but do not extend southward to the vicinity of Melvern lake. Deposits of wind blown soils are found in upland areas as thin veneers in Osage county (U.S. Army Corps of Engineers District, Kansas City, Missouri 1975, and U.S. Department of Agricultural Experiment Station Cooperating 1951:1). The residual soils of the county were formed from the weathering of limestone, shale, and sandstone and commonly occur on uplands. Bottomlands and upland slopes consist of alluvial soils. Alluvial soils in the bottomlands are of recent origin while those on the upland slopes are of possible Pleistocene association (U.S. Department of Agriculture, Soil Conservation Service and the Kansas Agricultural Experiment Station Cooperating 1951:1). Most of the alluvial soils are now

inundated by Melvern lake, but the downstream area, in the vicinity of the Cow-Killer site, still contains large tracts of alluvial soils. The surviving alluvial soils have the best agricultural potential of any soils within the county. The bottomland and terrace soil in the vicinity of the Cow-Killer site is listed in the U.S. Department of Agriculture bulletin as being a deep, friable, silty to clay soil (U.S. Department of Agriculture, Soil Conservation Service and the Kansas Agricultural Experiment Station Cooperating 1951:5). The description provided for this particular soil in the U.S.D.A. publication is as follows:

The soil has a brownish-black to brownish gray, friable, silt loam surface 10-14 inches thick which is neutral to slightly acid. This is underlain by a friable, granular, brownish gray to weak brown silt loam to silty clay loam to a depth from 20-24 inches. The lower subsoil is pale brown to light yellowish brown, friable silty clay loam containing rust-brown and gray mottling (U.S. Department of Agriculture, Soil Conservation Service and the Kansas Agricultural Experiment Station Cooperating 1951:5).

Hydrologically, the Melvern lake area is dominated by the Marais des Cygnes river which has its origin in Wabaunsee and Lyon county, Kansas. The river flows in a generally southeasterly direction, joining the Little Osage river in Missouri to form the Osage river. The flood plain of the river varies in width from approximately 1,500 to 5,100 ft. The valley slopes are moderate, with the southern slopes of the valley generally being steeper than those on the north side (Aldenderfer 1980:9). Drainage in the upland area displays a branching pattern, typical of the clay soils found in the area (Schoewe 1949). In a Corps of Engineers publication dealing with the flood plain of the Marais des Cygnes, it is noted that the Marais des Cygnes river and its tributaries are subject to flood flows resulting mainly from runoff that occurs due to intense rainfall (1973:5).

The shape of the basin, pattern of the drainage system, topographical conditions, and fairly dense soils found in the basin are contributing factors toward rapid concentration of runoff into flood-producing discharges. About 75 percent of all flood stages recorded at Ottawa have occurred

during the period April through July, but severe floods may occur during other months (Corps of Engineers, U.S. Army, Kansas City District 1973:5).

Osage county and the surrounding area has a typical continental climate, with warm summers and moderately cold winters. Osage county is in the wettest portion of Kansas with an average rainfall of approximately 35 inches per year. Most of the precipitation falls in the growing season in the form of rain. The average frost free season is about 187 days, April 15 to October 20. The prevailing wind is from the south. Temperature records at Ottawa, Kansas, indicate that the months of July and August are the hottest and January is the coldest. The average annual maximum temperature is 67 degrees Fahrenheit and the average annual minimum is 44 degrees Fahrenheit (Flora 1948).

The flora of the area in the prehistoric and early historic period can be estimated by reference to soil survey data and early historical accounts. The picture obtained is one of open prairie penetrated by thin ribbons of riparian forest that are largely limited to the drainages. Kuchler (1974) lists the Osage Cuestas as part of the Tall Grass Prairies and describes it more specifically as an area with extensive interspersions of forest and prairie. Archeological site 140S347, in particular, is located within an area that Kuchler describes as Flood Plain Forest and Savannah in terms of its potential natural vegetation (Kuchler 1974). Wedel has described the regional vegetation pattern as follows:

In their original state, the Osage Plains were primarily a tall grass prairie, with big bluestem dominating the rolling plains between streams and much of the valley bottoms as well. The immediate streambanks and adjacent valley floors were heavily timbered with oak, black walnut, elm, linden, sycamore, locust, hickory, pecan, and other hardwoods. Smaller forms that undoubtedly entered into the native economy of the Indians included Osage orange or Bois d'arc, persimmon, papaw, elderberry, serviceberry, choke cherry, and wild grape (Wedel 1959:14).

The final environmental statement for the operation and maintenance of Melvern dam and lake indicates that the flora of the Melvern lake area is today quite varied.

Narrow strips of vegetation that occur along the Marais des Cygnes river and tributaries are generally of the ash-cottonwood type with considerable numbers of sycamore, burr oak, American elm, box elder, and silver maple. Upland tree species include honey locust, Osage orange, and Kentucky coffee tree. Shrubs and vines of the lake area include riverbank grape, elderberry, poison ivy, aromatic sumac, wild plum, and green-brier...Much of the area around Melvern lake is natural rangeland, with the project area lying within the Kansas-Oklahoma bluestem region grassland, which is a mixture of tall and mid-sized grasses. Big bluestem (*Andropogon furcatus*) is dominant on the lower slopes and little bluestem (*Andropogon scoparius*) on the upper slopes (U.S. Army District, Kansas City, Missouri 1975:ii-18).

Detailed soil survey data for Osage county is lacking at the time of this report preparation. When such information becomes available, it should be possible to delimit the natural vegetation under which particular soils developed. Soil survey information from Shawnee county to the north and from nearby Anderson and Woodson counties suggest that the bottomland and flood plain soils of the rivers in this region developed under both tall grass and hardwood conditions (U.S. Department of Agriculture, Soil Conservation Service in cooperation with Kansas Agricultural Experiment Station 1970; Sallee 1977).

The suggestion of the partially timbered and also grass-covered flood plain with predominately grass-covered uplands is supported by documentary evidence from early white explorers in the Marais des Cygnes river valley. In particular, the Reverend Isaac McCoy traveled from St. Louis westward up the Osage river and eventually passed through the valley of the Marais des Cygnes river in the late summer of 1828 (Barnes 1936, Wilmeth 1960, Aldenderfer 1980). Barnes's account of Isaac McCoy's journal, combined with Wilmeth's map of McCoy's route, would suggest that McCoy was in Osage county and in the general vicinity of Melvern lake in the period from September 8 to September 10, 1828 (Barnes 1936, Wilmeth 1960). Interestingly, on September 9, 1828, McCoy's account goes as follows:

We left camp at a quarter past eight. In the course of about two miles happen on a fine spring of water running out from limestone rocks. At noon crossed a large creek running alongside a steep hill of limestone. Here we stopped half an hour and ate a bite. Timbered bottom half a mile wide, very rich, covered heavily with black walnut, hickory, honey locust--(ms. illegible), oak, some (ms. illegible) tree, mulberry, etc. Afterwards crossed two small creeks each affording water but running. At four reached a large creek, spent an hour in crossing and at five camped on its west bank. The bottoms of all the creeks were wide and rich. The creeks this afternoon were muddy, less stone less current than yesterday. Timber about the same as yesterday, land the same though with less stone to be seen. The country in which we encamped last night, I supposed to be well watered with spring (Barnes 1936: 249).

While the specific location of McCoy's encampment can certainly not be determined at this time, nevertheless, his account of available timber and other flora within the valley of the Marais des Cygnes river is interesting and supportive of more general information about the nature of the potential natural vegetation in this area. Aldenderfer (1980:11) suggests that the fauna and flora of the recent past were much more varied than the modern assemblage. Relying heavily on Dort and Jones (1970) and Wright (1970), Aldenderfer reconstructs the Osage Plains of the recent past as Tall Grass Prairie, with grasses found not only on the plains but on the valley bottoms as well. "Big bluestem was the dominant species. Then, as now, the streams were lined with trees or shrubs, although in the past, the stream edges were much more heavily wooded. In addition to all the modern trees, black walnut, linden, hickory, pecan, locust and other hardwoods were present. Osage orange, persimmon, and pawpaw were also common." (Aldenderfer 1980:11).

Faunal resources of various kinds were supported by the aforementioned vegetational conditions. Wedel, speaking of the Osage Plains in general, states that:

...The forested belts and nearby prairies provided shelter and food for an abundant mammalian fauna, chief among which were elk, white-tailed and mule deer, black

bear, cougar, wildcat, timberwolf, gray and red fox, raccoon, opossum, the gray fox, and flying squirrels, beaver, otter, muskrat, and cottontail rabbit. On the prairies were bison, coyote, antelope, jackrabbit, badger, and many smaller mammals. Among the numerous birds, the plentiful wild turkey was doubtless of primary importance to man; but prairie chicken, ruffed grouse, and quail were also useful, and the passenger pigeon and Carolina parakeet were present. The larger streams, usually running clear and unsilted, yielded an abundance of edible fish and shellfish (Wedel 1959:14).

Table 1, as abstracted from the Final Environmental Statement for the Operation and Maintenance of Melvern Dam and Lake, summarizes the present fauna of Osage county (U.S. Army Engineers, District Kansas City, Missouri 1975: ii-12 to ii-13). It should be noted that this table reflects only the modern fauna of the area and to these we must add the various aforementioned species such as bison, elk, etc. which were known to be indigenous to this area.

TABLE 1: A Partial List of the Modern Faunal Resources of the Melvern Lake Area, Excluding Man and Domestic Animals

Mammals (Hall 1955)

<u>Family</u>	<u>Number of Species</u>
<i>Canidae</i> (fox, coyote)	2
<i>Procyonidae</i> (raccoon)	1
<i>Talpidae</i> (mole)	1
<i>Didelphidae</i> (opossum)	1
<i>Soricidae</i> (shrew)	2
<i>Mustelidae</i> (skunk, mink, weasel)	5
<i>Cervidae</i> (deer)	1
<i>Sciuridae</i> (squirrels)	6
<i>Geomyidae</i> (gophers)	1
<i>Heteromyidae</i> (kangaroo rat, mice)	2
<i>Cricetidae</i> (mice, rat, mole, lemming, muskrat)	10
<i>Castoridae</i> (beaver)	1

TABLE 1 (Continued)

<u>Family</u>	<u>Number of Species</u>
<i>Muridae</i> (Old World mice, rats)	2
<i>Fopodidae</i> (jumping mouse)	1
<i>Leporidae</i> (hares, rabbits)	3
Reptiles and Amphibians (Smith 1956)	
<u>Order</u>	
<i>Testudines</i> (turtle)	13
<i>Squamata</i> (lizards)	9
<i>Serpentes</i> (snakes)	
<u>Family</u> <i>Columbridae</i> (harmless)	25
<i>Cretalidae</i> (pit vipers)	3
<i>Caudata</i> (salamanders)	6
<i>Salientia</i> (frogs and toads)	9
Birds	
<u>Order</u>	
<i>Gaviiformes</i> (grebes, loons)	3
<i>Pelicaniformes</i> (cormorants, pelicans)	2
<i>Ciconiiformes</i> (herons, bitterns)	7
<i>Aneriiformes</i> (ducks, geese, swans)	20
<i>Falconiformes</i> (vultures, hawks, falcons)	15
<i>Galliformes</i> (grouse, quail)	2
<i>Gruiformes</i> (cranes, rails)	5
<i>Charadriiformes</i> (shorebirds)	27
<i>Columbiformes</i> (doves)	2
<i>Strigiformes</i> (owls)	6
<i>Caprimulgiformes</i> (goatsuckers)	2
<i>Apodiformes</i> (hummingbirds, swifts)	2
<i>Coraciiformes</i> (kingfishers)	1
<i>Piciformes</i> (woodpeckers)	7
<i>Passeriformes</i> (perching birds)	122

TABLE 1 (Continued)

Fish (Cross 1967)

<u>Family</u>	<u>Number of Species</u>
<i>Clupeidae</i> (shad)	1
<i>Lepisosteidae</i> (gar)	1
<i>Cyprinidae</i> (minnow carp)	15
<i>Catostomidae</i> (suckers)	7
<i>Ictaluridae</i> (catfish)	6
<i>Centrarchidae</i> (sunfish)	6
<i>Percidae</i> (perch)	4
<i>Sciaenidae</i> (drum)	1

Wedel has pointed out that Kansas occupies a transitional zone climatically intermediate between the humid east and the arid west, and that this has, for that reason, long been an area subject to climatic fluctuations of greater or lesser magnitudes (1959:7). At the same time, it is clear that the grasslands are not a recent development; in fact, the present evidence suggests that the vegetative and faunal characteristic of the Kansas landscape "...long antedate man's demonstrable presence on the scene" (Wedel 1959:8). Buried soils indicate the presence of grasslands in Kansas throughout the Pleistocene, and molluscan fossils point to a climatic control like the present one since mid-Wisconsin times (Wedel 1959:8; Dort and Jones 1970; and Wright 1970). It can be assumed that human occupation at the Cow-Killer site in the Melvern reservoir area took place in an environmental setting roughly similar to that which is seen there today.

THE PREHISTORIC AND EARLY HISTORICAL CULTURAL SETTING

Osage county, Kansas, is one of the better known areas archeologically in the state of Kansas. This is due in large part to the fact that two federal reservoirs, Pomona and Melvern, have been constructed in the county and the construction of both of these reservoirs entailed considerable archeological work. In addition to this, work connected with highway salvage archeology and reports by amateur collectors in the county have accounted for additional sites recorded and in some cases investigated. In all, 123 archeological site locations are listed in the master file of known archeological sites for Kansas in the files of the Kansas State Historical Society. These appear to span a temporal range from at least several thousand years B.C. up to midnineteenth century sites that are associated with historically known Indian groups and the Euro-American settlement of the area.

While a large number of archeological sites are recorded from the county, unfortunately, the majority of these sites have not yet been investigated by professional archeologists and therefore our understanding of the cultural sequence and the cultural process in the area is rather limited. To adequately describe the nature of the various cultural groups which have inhabited the project area, it is therefore necessary to consider archeological data from throughout the Plains and particularly from eastern Kansas. Randall M. Thies, in a report entitled *Archeological Investigations at the John Redmond Reservoir, East Central Kansas, 1979*, has provided a thorough summary of the cultural historical setting for much of eastern Kansas and his manuscript will be referenced frequently in the following discussion. A large body of data is available for the archeology of eastern Kansas. Figure 2, Kansas Cultural Sequence, summarizes much of our present understanding of cultural and taxonomic relationships within the state. Much of our current archeological knowledge about eastern Kansas has been derived from research conducted in major reservoirs within the last twenty-five years. At the same time, it is well to recognize that the broad outlines of Kansas prehistory have been known for some time, as is evidenced in Wedel's definitive *An Introduction to Kansas Archeology* (1959) and *Prehistoric Man on the Great Plains* (1961).

The major eastern Kansas reservoirs (see Figure 1) for which published archeological reports are available include Council Grove (Witty 1961a, 1962a, 1964b), El Dorado (Bastian 1979, Homer 1974, Leaf 1976 and 1979, Eoff and Johnson 1968, and Grosser 1973), Clinton (Johnson 1968), Elk City (Marshall 1972, Brogan 1980a), Marion (Witty 1963a), Melvern (Wilmeth 1959, Bradley 1968, Moore and Birkby 1966, Smith and Birkby 1962a and

KANSAS CULTURAL SEQUENCE

ARCHEOLOGICAL PERIOD	TIME ESTIMATE	PHYSIOGRAPHIC PROVINCES					SUBSISTENCE PATTERN	
		Dissected Till Plains	Orange Cuestas	Flint Hills Uplands	Arkansas River Lowlands	Dissected High Plains		High Plains
HISTORIC	A.D. 1870	IMMIGRANT TRIBES	IMMIGRANT TRIBES	IMMIGRANT TRIBES	WICHITA COMANCHE	CHEYENNE SIOUX	COMANCHE CHEYENNE ARAPAHOE KIOWA KIOWA-APACHE SIOUX PAWNEE	EURO-AMERICAN SETTLEMENT HORSE NOMADS HUNTING BISON SOME HORTICULTURE
		KANSAS	OSAGE KANSAS	OSAGE KANSAS	CHEYENNE KIOWA KIOWA-APACHE	COMANCHE PAWNEE		
historic LATE CERAMIC protohistoric	A.D. 1800	KANSAS ONEOTA TRADITION	OSAGE WICHITA NEOSHO FOCUS	OSAGE KANSAS NEOSHO FOCUS GREAT BEND ASPECT	KIOWA KIOWA-APACHE COMANCHE WICHITA GREAT BEND ASPECT	KANSAS PAWNEE WHITE ROCK ASPECT GREAT BEND ASPECT	PAWNEE COMANCHE CUARTELEJO APACHE DISMAL RIVER ASPECT	HUNTING, HORTICULTURE, AND GATHERING
MIDDLE CERAMIC village farmer	A.D. 1500	NEBRASKA PHASE CLINTON PHASE STEED-KISKER PHASE POMONA FOCUS	CLINTON PHASE POMONA FOCUS	SMOKY HILL PHASE POMONA FOCUS	PRATT COMPLEX BLUFF CREEK COMPLEX	UPPER REPUBLICAN PHASE SMOKY HILL PHASE	PRATT COMPLEX UPPER REPUBLICAN PHASE	HUNTING, HORTICULTURE, AND GATHERING
plains woodland EARLY CERAMIC middle woodland	A.D. 1000	DEER CREEK PHASE WAKARUSA PHASE GRASSHOPPER FALLS PHASE VALLEY FOCUS KANSAS CITY HOPEWELL	GREENWOOD PHASE GRASSHOPPER FALLS PHASE CUESTA PHASE	SCHULTZ FOCUS BUTLER PHASE GREENWOOD PHASE	KEITH FOCUS KANSAS CITY HOPEWELL	KEITH FOCUS	KEITH FOCUS	HUNTING AND GATHERING WITH INCIPENT HORTICULTURE
ARCHAIC	c.a. A.D. c.a. B.C.	NEBO HILL PHASE	NEBO HILL PHASE EL DORADO PHASE MUNKERS CREEK PHASE	WALNUT PHASE EL DORADO PHASE CHELSEA PHASE MUNKERS CREEK PHASE	MATTER MOUND UNIDENTIFIED ARCHAIC CULTURAL MANIFESTATIONS		HUNTING AND GATHERING	
PALEO-INDIAN	6,000 B.C. 8,000 B.C.	OCCASIONAL DISCOVERIES OF PALEO-INDIAN PROJECTILE POINTS THROUGHOUT KANSAS					TWELVE MILE CREEK	BIG GAME HUNTING

FIGURE 2: Kansas cultural sequence

1962b, Traub 1975), Milford (Witty 1963b, Muller and Schock 1964, Sperry 1965), Perry (Reynolds 1979), Pomona (Wilmeth 1970), Toronto (Howard 1964), Tuttle Creek (Solecki 1953, Cummings 1958, Johnson 1973, Schmits 1976), John Redmond (Thies 1980, Witty, et. al, 1980), Big Hill (Rowlison 1977 and 1978) and the proposed Cedar Point (Wood 1977) and Onaga (Reynolds 1970, 1971) reservoirs. Additional information about the archeology of eastern Kansas has been provided through survey and excavations connected with the Cooperative Agreement for Highway Archeological Salvage programs, through a similar agreement with the U.S. Department of Agriculture, Soil Conservation Service, and through other research interests of professional archeologists working at the Historical Society and at the three major state universities, Wichita State University, Kansas State University, and Kansas University.

One difficulty encountered in comprehending the culture history and the culture diversity of the Central Plains archeological subarea (Wedel 1961) is the fact that several different classificatory schemes have been employed and are currently employed in various areas of the Central Plains and in adjoining areas. Plains Woodland, for instance, a recognized taxon in the Central Plains in Nebraska, Kansas and Oklahoma, apparently has little credence as a taxonomic unit in Missouri (Chapman 1980). The adoption of two different taxonomic classifications during the period from 1939 to the present has further complicated the issue. During the period from approximately 1934 up through the 1950s and into the 1960s, the Midwestern Taxonomic System or MTS system was widely employed by archeologists working in the Plains (McKern 1934, 1939; Gradwohl 1969; Reynolds 1979). The Midwestern Taxonomic System was gradually supplanted by the Cultural Historical Integration method for classifying archeological remains beginning in the early 1950s (Willey and Phillips 1958).

The author is aware of the difficulty that arises when two or more different taxonomic systems are utilized. Nevertheless, these somewhat variant taxonomic usages are well entrenched in the archeological literature of the Central Plains and unless or until the older MTS defined units are redefined, the author believes that he has a responsibility to utilize the traditional terms. The need for this becomes obvious when we consider a taxonomic unit like Keith focus. Kivett first defined the Keith focus as an MTS unit on the basis of sites excavated in the Medicine Creek reservoir, Hitchcock county, Nebraska, and Phillips county, Kansas (1949a, 1952, 1953). As a Midwestern Taxonomic System unit, the Keith focus was defined solely on formal grounds. Spatial and temporal considerations were specifically excluded from the initial definition. The Grasshopper Falls phase, defined

as a unit within the Cultural Historical Integration taxonomic system, has built into the definition formal, temporal, and spatial considerations (Reynolds 1979). While the terms Keith focus and Grasshopper Falls phase are both intended to define Plains Woodland complexes, it is evident that the complexes so defined are not of the same magnitude. When more recent syntheses of presumably outdated taxonomic usages were available, the author utilized the more current schemes. For example, Lehmer defined the Central Plains tradition as a Cultural Historical Integration substitution for the earlier defined Central Plains phase (1952, 1954a, 1954b). Subsequent use of the term Central Plains tradition by Gradwohl (1969), Brown (1966) and others suggests that this substitution has met with at least some acceptance among Central Plains archeologists. Accordingly, the author has followed Lehmer's usage of Central Plains tradition in this report.

The general outline for the culture history of Kansas as employed here is an outgrowth of a simplified scheme proposed by the Kansas Antiquities Commission (Witty 1979). This scheme, as presented in Figure 2, divides the prehistoric and historic archeological cultures in Kansas into a number of cultural periods, i.e., Paleo-Indian, Archaic, Early Ceramic, Middle Ceramic, Late Ceramic, and Historic. The Kansas Antiquities Commission then attempts to recognize distinctive archeological cultures, whether MTS classification of Cultural Historical Integration, within six distinct physiographic provinces within Kansas; i.e., Dissected Till Plains, Osage Cuestas, Flint Hills Upland, Arkansas River Lowlands, Dissected High Plains, and High Plains. As we have mentioned earlier, Melvern lake lies within the Osage Cuestas and is bordered on the west by the Flint Hills Upland and to the north by the Dissected Till Plains. There are inherent problems in adopting any one particular classificatory scheme. While the Kansas Antiquities Commission scheme, with its division of the historic and prehistoric past into temporally discrete units, such as Paleo-Indian period and Archaic period, is utilized herein, it is done so with an understanding of at least some of its limitations. The artificial boundaries imposed by such separation into distinct cultural periods can be very stifling to our understanding of culture history. For instance, the Archaic, which is often referred to as the Foraging period, can usefully be viewed as a broad tradition without constricting temporal limits applied to it. Nevertheless, the cultural sequence as presented here does provide at least a usable vehicle for looking at cultural developments within the Central Plains and, more specifically, eastern Kansas.

PRECERAMIC CULTURES

The Paleo-Indian Period

The earliest known inhabitants of the Plains, and the ones about which least is known, are referred to as Paleo-Indian (Roberts 1940). The temporal limits of the Paleo-Indian period are a matter of debate. Caldwell and Henning (1978:118) note that Haynes (1971) has suggested a tripartite division of the Paleo-Indian into Early, Middle, and Late periods. Caldwell and Henning further note that the Early period, dating pre 25,050 B.C., has not yet been authenticated in the Plains region. The Middle Paleo-Indian period, dating from perhaps 25,050 B.C. to 10,000 B.C., may be represented in the Plains by a single archeological site, the Cooperton site in Oklahoma (Caldwell and Henning 1978:118; Anderson 1962; Gilbert 1980). The Late Paleo-Indian period, dating at circa 10,000 B.C. to 5,500 B.C. is represented in the Plains region by several cultural groups including the Llano and Plano complexes (Caldwell and Henning 1978:118). It should be noted that there is considerable disagreement among scientists as to a terminal date for the Paleo-Indian period in the Plains area. As noted above, Caldwell and Henning (1978:118) suggest a very late date, 5,500 B.C. for the termination. Johnson, however, in specifically discussing the Central Plains, suggests a date of circa 8,000 B.C. for the beginning of the subsequent archeological period, the Archaic (1980:1). Wedel has noted that Paleo-Indian and Archaic complexes were apparently coextensive in the Plains with a suggested temporal overlap of several thousand years (1978:196). While it is possible to assign rather precise dates to the Late Paleo-Indian and Early Archaic periods in some subareas of the Plains, such as the Northwestern Plains, insufficient data is presently available for the Central Plains to allow for such distinctions (Wedel 1978:199). Since most of the known Paleo-Indian sites are kill sites or butchering sites containing the remains of now extinct animal forms such as mammoth, mastodon, and bison, the tradition or period is often referred to as the Big Game Hunting tradition or period. It is assumed, however, that the hunting of small animals and gathering of wild plant foods were also important aspects of the Paleo-Indian economy.

Late Paleo-Indian sites are primarily identified by the presence of any of a variety of distinctive projectile points of the Llano and Plano complexes, including such types as Scottsbluff, Eden, Plainview, and the fluted Clovis and Folsom. Late Paleo-Indian sites have been found at several locations in the Plains, particularly the western Plains and the adjacent Southwest (Caldwell and Henning 1978). In Kansas, no significant Paleo-Indian sites warranting excavation have yet been identified. Surface finds of fluted and/or lanceolate

projectile points of Paleo-Indian type have been reported from various locations in the state, primarily by private collectors. Interestingly, one of the earliest recorded associations of a probable Paleo-Indian projectile point with extinct animal bones was made in Logan county in western Kansas in the late 1890s (Reynolds 1980; Williston 1902).

The Archaic Period

The climatic fluctuations associated with the end of the Pleistocene glaciation are thought to have been influential in bringing about changes and the development of the next distinctive preceramic cultural period, the Archaic, which began circa 8,000 B.C. in some areas of the Plains and continued, at least in Kansas, until the beginning of the Christian era (King 1980). The climatic changes are apparently correlated with the extinction of the Pleistocene megafauna and the development of a dry, or warmer climate, a climate somewhat hotter and more arid at the outset than that experienced today (King 1980).

The Archaic period is apparently marked by a seasonally shifting subsistence-settlement system, more regionally oriented and less nomadic than the Paleo-Indian pattern. Archaic groups continued to be hunters, but they exploited modern fauna such as bison, elk, deer, etc. The appearance of stone grinding slabs during this time period suggests an increased reliance on plant foods, predominantly wild foods, but possibly some cultigens in at least some areas of the eastern United States (Kay 1980).

The generalized Archaic artifact inventory differs from that of the Paleo-Indian and includes such items as ground stone axes, celts, gouges, and beads as well as the previously mentioned grinding slabs. Chipped stone axes, celts, knives, gouges, and other bifacially flaked objects were also produced. Archaic projectile point forms are more diversified and include lanceolate-shaped projectile points, lacking fluting, as well as stemmed points and side, corner, or base notched projectile points. Burial mounds, which are most often affiliated with post-Archaic manifestations in the Central Plains, may occur as an Archaic trait as well. Two excavated mounds in the north central portion of Kansas yielded diagnostic artifacts suggesting a Late Archaic affiliation (Reynolds 1977).

The Archaic period is much better represented than the Paleo-Indian, with several distinct cultural manifestations identified so far (Johnson, et. al 1980). As with the Paleo-Indian period, the Archaic period in the Plains has been divided into three temporal periods, Early, Middle, and Late (Joyer and Roper 1980). While it is impossible to assign

exact dates to the Early, Middle and Late Archaic, a suggested temporal sequence is; approximately 8,000 B.C. to 6,000 B.C. for the Early Archaic, 6,000 to 3,000 B.C. for the Middle Archaic, and 3,000 B.C. to A.D. 1 for the Late Archaic in Kansas. These temporal divisions seem to be correlated with broad environmental changes that were happening on the Plains and on the Prairie Plains during the Holocene. For instance, the Middle Archaic correlates roughly with what King calls the Hypsithermal interval of the Holocene (King 1980). The Hypsithermal is correlated in Kansas with a shift in vegetation from forest/prairie to more prairie (King 1980:9).

As indicated earlier, the Late Paleo-Indian period is represented in Kansas by the finding of the distinctive Plainview, Dalton, Meserve, etc. projectile points. There seems to be a gradual transition to the Early Archaic complexes which are represented in the Plains by such distinctive projectile point forms as Graham Cave side-notched, as well as projectile points similar in form to those recovered at the Logan Creek and Simonson sites in Nebraska and Iowa, respectively (Frankforter and Agogino 1960; McKusick 1964).

The earliest radiocarbon dates reported from an Archaic site in Kansas are a series of three dates obtained from the Sutter site, 14JN309, in northeastern Kansas (Katz 1973). The three dates had an average mean of 5,875 B.C. and an average range from 6,118 B.C. to 5,633 B.C. when one standard deviation was employed (Katz 1973:168). Within the same general level were found lanceolate and parallel sided, stemmed projectile points, leaf-shaped chert blades, chert scraping tools, chert flakes, a possible ground stone celt, two handstones used for grinding and two sandstone grinding slabs (Katz 1971:6-14). The site investigator, Paul Katz, saw a resemblance between the Sutter site and the Frederick and Cody complexes of the Late Paleo-Indian period (Katz 1973:168). However, all of the faunal remains recovered from the site area were of modern species (Katz 1971:15). This site area had suffered considerably from construction activity connected with a watershed project and this complicated the site interpretation. It seems probable, nevertheless, that this site is attributable to the Early Archaic period.

A number of archeological sites have yielded radiocarbon dates which fit comfortably within the Middle Archaic period. A deeply buried charcoal lense at the Coffey site, 14P01, in Tuttle Creek reservoir was dated at 4,335 B.C. \pm 145 (Schmits 1976:25). While no culturally diagnostic artifacts were recovered in association with this lense, Schmits notes that it underlay a stratigraphic series of deposits which he attributes to the Late Archaic (1980a:79). At archeological site 14LT319 in Big Hill reservoir, wood charcoal from a deeply buried hearth was

dated at 3,600 B.C. \pm 215 (Rowlison 1977:118). No diagnostic cultural materials were found in association with the hearth. A wood charcoal sample recovered from a hearth at the Durbin site, 14EK331, in southeast Kansas, was dated at 3,650 B.C. \pm 110 (Barr 1974:30). The Durbin site, discovered in a disturbed condition in conjunction with a watershed construction project, yielded a variety of chipped stone implements which included lanceolate, side notched and corner notched projectile points that bear close resemblances to Archaic dart forms from Kansas, Oklahoma, Texas and Missouri (Barr 1974:34).

The Munkers Creek phase (Witty 1969:2) is apparently assignable either to the later part of the Middle Archaic period or the early part of the Late Archaic period. The type site for the Munkers Creek phase is the William Young site at Council Grove reservoir in the Flint Hills, some 45 miles west of the Melvern lake area. Diagnostic artifacts recovered from the William Young site include thick, stemmed, lanceolate projectile points, curved bifacial knives with a possible silica gloss or polish on both faces, gouges, chipped stone celts, etc. Also recovered at the site were two small triangular-shaped effigy human heads which may be some of the oldest ceramics yet recovered on the Plains (Witty 1962b:5). Radiocarbon dates from the Munkers Creek component suggest a possible range from about 3,500 B.C. to 1,000 B.C. (Witty 1969). Another Late Archaic component identified at the William Young site in Council Grove reservoir is apparently related to the El Dorado phase, a Late Archaic manifestation first defined on the basis of excavations in the El Dorado reservoir area of southern Kansas (Grosser 1973).

The Coffey site, 14P01, a highly stratified multicomponent archeological site in Tuttle Creek reservoir, has yielded evidence of a series of Archaic cultural horizons (Schmits 1976:17). Unit III, which contained the primary Archaic horizons, yielded a series of radiocarbon dates which ranged from 3,730 B.C. \pm 135 to 2,850 B.C. \pm 95 (Schmits 1976:17). On the basis of stratigraphic consistency, Schmits selected mean dates ranging from 3,105 B.C. to 3,320 B.C. as representing the best chronological estimation for six of the Archaic horizons. Munkers Creek knives, Clear Fork gouges, and lanceolate projectile points similar to the Nebo Hill and Sedalia types were present in these horizons along with grinding slabs and several hearths. Ceramic evidence of great antiquity was also encountered here, as at the William Young site. The evidence consisted of one fired clay bead which was recovered from Horizon III-V and dated at circa 3,213 B.C. on the basis of radiocarbon determinations obtained from wood charcoal in the horizon (Schmits 1976:72). Schmits attributes these Archaic horizons to the Late Archaic period (1980a:79).

In the southern portion of the Flint Hills in Kansas, Middle and Late Archaic manifestations have been identified at the El Dorado reservoir (Grosser 1973). A chronological range from 2,800 to 2,000 B.C. has been suggested by Grosser for a possible Middle Archaic component, the Chelsea phase, which has produced short, squat projectile points comparable with those of the Logan Creek and Simonson complexes of eastern Nebraska and western Iowa (Grosser 1973:231). The earlier of the two Late Archaic manifestations in El Dorado has been termed the El Dorado phase, with radiocarbon dates of 1,700 B.C. and 1,960 B.C. being obtained at the Snyder site (Grosser 1973:234). Diagnostic projectile points of the El Dorado phase are similar to the Lamoka and Table Rock types (Ritchie 1969:50, Perino 1968:96). Structural evidence in the form of grass impressed daub, postmolds, and mud dauber nests, was encountered in the El Dorado phase level of the Snyder site (Grosser 1973:233). A later Archaic manifestation, termed the Walnut phase, was also represented at the Snyder site. This component yielded a radiocarbon date of 20 B.C., but is thought to have begun around 1,200 B.C. Projectile points of this phase are predominately small, triangular, and corner notched, although larger corner notched forms were also present (Grosser 1973:230-233).

At John Redmond reservoir, to the south of Melvern lake, a Late Archaic manifestation related to the El Dorado phase was recognized (Witty 1980:164). At the Williamson site, 14CF330, the Late Archaic component is represented by a relatively prolonged duration habitation zone with Unit II. Two radiocarbon dates, 1,550 B.C. \pm 100 and 1,650 B.C. \pm 100, are available for the Archaic component at the Williamson site (Schmits 1980:23). Schmits (1980) noted the occurrence of Sedalia like lanceolate projectile points, Table Rock and Lamoka (Dustin) types which bear relationships with Snyder and Coffey Late Archaic components in Kansas and with the Sedalia complexes of Missouri. The Williamson site also yielded evidence of human burials and demonstrated the presence of dogs during the Late Archaic period in Kansas (Schmits 1980).

Another recognized Late Archaic cultural manifestation in the eastern part of the Central Plains is the Nebo Hill phase (Shippee 1948, Reid 1980, Reeder 1980). Radiocarbon determinations from the type site of Nebo Hill in western Missouri suggests that the complex dates roughly to 1,600 B.C. (Reid 1980). The central area of the Nebo Hill phase appears to be located in the vicinity of Kansas City although the diagnostic Nebo Hill lanceolate points have been identified from numerous areas of eastern Kansas and western Missouri.

A number of deeply buried archeological sites of probable Late Archaic cultural affiliation have been uncovered in eastern Kansas in conjunction with watershed and reservoir construction projects. In summarizing this information, Calabrese (1967) notes that available radiocarbon determinations suggest a chronological placement in the second millenium B.C. A radiocarbon sample from site 14GR307 in the Upper Verdigris watershed was dated at 1,300 B.C. \pm 140 (Calabrese 1967:12). No artifacts were found during the excavation of this site, but the carbon sample was recovered from an intentionally prepared hearth. A second site in the Upper Verdigris watershed, 14LY305, also contained hearths which lacked diagnostic cultural materials (Calabrese 1967:13). A charcoal sample recovered from one of the hearths was dated at 1,830 B.C. \pm 180 (Witty 1965). Wood charcoal recovered from a hearth which was situated in the lowest level of a multicomponent site in the Elk City reservoir, 14MY309, was dated at 1,730 B.C. \pm 180 (Marshall 1972:99). Unfortunately, no diagnostic artifacts were found in association with this deeply buried level.

It is evident from the preceding discussion that our knowledge about the Archaic period in Kansas is still incomplete. Nevertheless, an occupation of this area by Archaic peoples during at least the latter part of the Middle Archaic and during the Late Archaic is certain.

CERAMIC CULTURES

The Archaic period, as presently understood, came to an end on the Plains around the beginning of the Christian era, apparently as the result of the diffusion of new technologies, adaptations, and probably social systems, from the eastern Woodlands (Thies 1980:13). A developed ceramic technology is the most archeologically obvious of the technological advances and for this reason and others, the post-Archaic cultural manifestations have come to be grouped together under the classification of ceramic cultures (Champe 1946). Reid (1980) has noted that fired clay ceramic vessels apparently have an antiquity in the Central Plains region that goes back into the Late Archaic (1980) and we have already noted the early appearance of other ceramic materials such as the fired clay effigy human heads at the William Young site in Council Grove and the finding of a fired clay bead at the Coffey site in Tuttle Creek. Nevertheless, it is during the Early Ceramic period that ceramic vessels, represented typically by potsherds, become a common and recurrent item at archeological sites.

Another major technological change which occurs during the Early Ceramic period is the apparent acceptance of the bow and arrow, as represented by projectile points that have been interpreted as arrowpoints. In terms of the subsistence-settlement systems, the Early Ceramic period is apparently a time when cultigens were introduced into the Central Plains area although, as we have noted, cultigens may have made an appearance in the eastern Woodlands during the Archaic period. Another trait often associated with the Early Ceramic period is the appearance of distinctive burial mounds, either of earth, earth and rock, or rock construction (Willey 1966:267). While such mounds have been demonstrated to occur in association with at least some Early Ceramic period complexes, at least some of the burial mounds found in Kansas may date from the Late Archaic period, suggesting an earlier diffusion of this particular trait to this region (Reynolds 1977).

The Early Ceramic Period

In Kansas, as well as in northwestern Missouri, the beginning of the Early Ceramic period evidently involved the actual migration of people as well as the diffusion of ideas from the eastern Woodlands. In the eastern United States, the Woodland period, which roughly equates with our present usage of the term Early Ceramic, is divided into three sequential periods, the Early, Middle, and Late Woodland. As Nathen, et. al (1980:23) has noted, this tripartite division of the Woodland period is not easily applicable to the Central Plains archeological subarea.

In Kansas, the archeological record currently contains no evidence of Early Woodland complexes comparable to those identified in the Lower Illinois valley, i.e., Marion, Peisker and Black Sand phases (Streuver, 1968:146). The earliest Woodland manifestations in Kansas appears to be similar to the Middle Woodland complexes that have been identified in the Lower Illinois valley. Thus, the one part of this tripartite division that has utility in ordering the archeological record in Kansas is the Middle Woodland period which is represented in Kansas by such distinctive complexes as Kansas City Hopewell (Johnson 1976, 1979 and 1980; Katz 1974). It has long been recognized that at least two different Early Ceramic period cultural complexes were present in the Central Plains area (Wedel 1959:542-557). The earlier recognized and more complex of these has been termed the Hopewellian phase by Wedel while the other technologically simpler grouping is known as the Plains Woodland (Wedel 1959:535).

The formal content of Early Ceramic period manifestations in Kansas has some uniformity but also differs. The Early Ceramic period was characterized by a variety of structural and artifactual elements, of which burial mounds are perhaps the most dramatic. Burial mounds are usually found on prominent bluff tops overlooking major stream valleys, primarily in the northeast part of the state and they are not associated with all Early Ceramic period cultural manifestations. Other structural evidence found at Early Ceramic sites includes house remains. House remains have been found associated with the Cuesta phase, the Greenwood phase, the Wakarusa phase, and the Grasshopper Falls phase sites in Kansas and house remains are reported for Valley focus and Keith focus in Nebraska (Reynolds 1979, Johnson 1968). House remains of the Greenwood and Grasshopper Falls phase sites include structures at least partially covered with clay daub plastered over thatched grass.

The Early Ceramic artifact inventory includes ceramics along with tools and ornaments made of stone, bone and shell. The pottery vessels are medium to large in size, with conoidal bases and relatively straight and sometimes outwardly bulging sides. Middle Woodland Hopewellian vessels exhibit smooth surfaces and are often decorated by cross-hatching and/or zoned dentate and rocker stamping which is usually confined to the rim and upper body of the vessel (Thies 1980:16). Plains Woodland vessels are typically medium to large sized, plain, wide mouthed jars, with cord-roughened exterior surfaces.

Chipped stone artifacts of the Early Ceramic period include considerable diversity of forms and sizes. Both small and large projectile points of a variety of types are common, suggesting the presence both of darts and the bow and arrow. In general, Early Ceramic projectile points are triangular or somewhat ovate, with expanding, straight, or contracting stems formed by notching at or adjacent to the corners of the points. Also present are large to medium sized, ovate to triangular, thin, plain, or stemmed bifaces possibly used as cutting tools, i.e., knives, as well as thicker ovate or triangular pieces used for chopping tools (Thies 1980:16). Drills and scrapers, in a variety of shapes and sizes are also found. The ground stone inventory includes grinding slabs and mullers, full and three-quarter grooved axes, ornaments such as gorgets, and such paraphernalia as smoking pipes. Bone tools, utensils, and ornaments were also made, along with shell ornaments, pendants, and disc beads (Thies 1980:16).

The spatial distribution of the recognized Early Ceramic period cultural complexes in Kansas is indicated on Figure 2. This suggests that the Kansas City Hopewell complex is limited basically to the Dissected Till Plains physiographic area although

it may also occur in the Osage Cuestas and the Arkansas River Lowlands as well as the Flint Hills Upland. The distribution of the Cuesta phase seems to be limited at this time to the Osage Cuestas. The Grasshopper Falls phase, while it is limited primarily to the Dissected Till Plains, also occurs in the Osage Cuestas. In particular, Grasshopper Falls ware, the distinctive ceramic ware of the Grasshopper Falls phase, has been identified in John Redmond reservoir at the Gilligan site (Witty et. al 1980:75) and at 140S343 on Frog creek to the south of Melvern lake (Reynolds 1975). The Wakarusa and Deer Creek phases are limited at this time to the Clinton reservoir area in northeast Kansas (Johnson 1968). The Butler and Schultz phases appear to be restricted primarily to the Flint Hills Upland while the Keith variant is found in much of western Kansas. Valley focus appears to be limited to the Dissected Till Plains. The Greenwood phase is represented in the Flint Hills Upland and the western part of the Osage Cuestas.

The chronological positions of many of the Early Ceramic period complexes, particularly Plains Woodland complexes, is tentative at this time because of a lack of reliable radiocarbon dates. Nevertheless, it seems clear that Plains Woodland complexes were at least in part coeval with Middle Woodland complexes such as Kansas City Hopewell phase and Cuesta phase and that they may in fact antedate them in some areas (Reynolds 1979). It seems equally clear that most of the Plains Woodland complexes postdate at least Kansas City Hopewell, with a suggested chronological placement for the Plains Woodland complexes from perhaps A.D. 300 to A.D. 1000 or even slightly later (Reynolds 1979).

The Kansas City Hopewell complexes are one of the better known of the Hopewellian occupations of Kansas as they have been extensively investigated by Wedel and more recently by Johnson and others (Wedel 1959; Johnson 1976, 1979, 1980). Suggested dates for Kansas City Hopewell components, based on a series of radiocarbon dates from sites in northwestern Missouri and northeastern Kansas, are from the beginning of the Christian era to about A.D. 500 (Johnson 1979:87).

According to Wedel, Kansas City Hopewell is "...probably the most advanced and complex of the Woodland manifestations in the Kansas region..." (1959:542), although "...clearly a watered down version..." (1961:89) of the Middle Woodland Hopewell cultures of Illinois and Ohio. Although Kansas City Hopewell centered in the Kansas City area, remains attributable to this culture have also been found to the west as village sites and burial mound sites, primarily along the Kansas river drainage. The Ashland Bottom site, located near Manhattan, Kansas, for example, has been identified as Kansas City Hopewell on the basis of pottery and other artifacts found

at the site area (O'Brien 1979:18). Kansas City Hopewell materials are reported to the south of the Melvern lake area in the John Redmond area. Here, sherds with Hopewell characteristics were recovered at the Gilligan site, 14CF332, and at the Arrowhead Island site, 14CF343 (Thies 1980:14).

The Kansas City Hopewell material has affinities with other Middle Woodland related sites that are located in southeastern Kansas. Marshall (1972) defined two variants of the Middle Woodland, the Cuesta phase and the Hopewell phase from southeastern Kansas, both of which have lithic and ceramic trait relationships with Middle Woodland sites in Missouri, Illinois, and Oklahoma. More recent work with the Cuesta phase materials in southeast Kansas (Rowlison 1977, 1978; Brogan 1980a, 1980b) have further documented the formal, temporal, and spatial relationships of this important complex. Another Hopewell related complex, the Cooper focus, has been reported from northeastern Oklahoma (Baerreis 1953). The temporal relationships of the Cuesta phase are less well known than Kansas City Hopewell because of inconclusive radiocarbon dates that have been obtained from southeastern Kansas excavations of these sites, but they nevertheless suggest a slightly later chronological setting than the Kansas City Hopewell materials (Brogan 1980a).

Cuesta phase sites, located primarily in the Verdigris, Fall and Elk river drainages, include both complex, nucleated villages and scattered, extended villages (Brogan 1980b). Excavated houses were either oval or round in shape, and were evidently covered by a fabric of material lighter than earth or sod, judging from the widely set postmolds and the lack of abundant burned earth. Cuesta phase ceramics are clay tempered, making them easily differentiated from the grit tempered Kansas City Hopewell pottery. Cuesta phase sites have yielded distinctive Havana pottery ware as well as sherds with later Hopewellian motifs and this supports a somewhat later temporal positioning for the phase than for the Kansas City Hopewell (Thies 1980:14).

The other main cultural unit of the Early Ceramic period has been termed the Plains Woodland. Wedel has recognized the validity of this broad cultural unit in such publications as *An Introduction to Kansas Archeology* (1959) and *Prehistoric Man on the Great Plains* (1961). The Plains Woodland includes cultural manifestations which are technologically simpler than the Middle Woodland complexes. The earlier defined subdivisions of the Plains Woodland were established for sites excavated in Nebraska and include such groups as Keith focus, Valley focus, Sterns Creek

culture, and Loseke Creek focus (Wedel 1959:549-557). Of these, only the Keith focus and Valley focus have so far been identified in Kansas. In the last 20 years, several regional variants of the Plains Woodland pattern have been recognized in Kansas. These include the Grasshopper Falls phase, the Greenwood phase, the Schultz, focus, the Butler phase, the Wakarusa phase, the Deer Creek phase as well as Keith focus and Valley focus (Reynolds 1979; Johnson 1968; Grosser 1973). In general, Plains Woodland complexes share sufficient similarities that they may be distinguished from other Early Ceramic complexes in Kansas. Rohn and Daniel (1979:115-116) characterize the Plains Woodland as follows:

...Plains Woodland has been applied to cultural complexes found in the grassland environment that exhibit several characteristics of the eastern Woodland pattern. These may include thick, coarse-tempered, cord-roughened pottery vessels with pointed bottoms and simple rims, large corner-notched or stemmed points, small habitations, apparent use of horticulture, economic exploitation or riparian resources, and occasional burial mounds.

Wedel in discussing Woodland settlements and subsistence patterns in the Central Plains, comments that:

Other than the Hopewellian, most Woodland sites in the Kansas-Nebraska region suggest a simple creek-valley hunting-gathering economy, with relatively small population aggregates. Squash and gourds in the Sterns Creek variant suggest horticulture, as does charred corn in Loseke Creek, neither of which manifestations has yet been reported from Kansas. The bones of deer, elk, and smaller woodland margin mammals and birds often predominate over those of bison in the refuse deposits; but it is not clear whether this reflects food preferences or, alternatively, hunting and butchering methods... (1959:626).

Reynolds (1979:79-80) suggests that Plains Woodland sites may represent what Caldwell (1958, 1962) has called a Primary Forest Efficiency adaptation to the Oak-Hickory Forest/Prairie environment of the Plains region. Recent

summaries of the Kansas City Hopewell have been provided by Johnson (1979, 1980); and Rowilson (1977, 1978), and Brogan (1980a and 1980b) have summarized our current knowledge about the Cuesta phase. Plains Woodland complexes have been dealt with in the *Grasshopper Falls Phase of the Plains Woodland* (Reynolds 1979) and *Salvage Archeology of the John Redmond Lake, Kansas* (Witty et. al 1980).

Component B at the Cow-Killer site has been attributed to the Greenwood phase and thus this Plains Woodland phase merits attention. The Greenwood phase is a Cultural Historical Integration phase proposed by Witty (1980) and identifying a prehistoric culture which inhabited portions of east central Kansas. This Plains Woodland complex has so far been identified at at least four excavated sites; the Curry site on the Upper Verdigris river, the Two Dog site at the Council Grove area, the Gilligan site at the John Redmond reservoir, and the Cow-Killer site at Melvern reservoir. Radiocarbon dates from the Greenwood phase sites span quite a temporal range. A date of A.D. 380 ± 230 was obtained from the Curry site while the Two Dog site yielded a date of A.D. 1045 ± 145 . A date of A.D. 550 ± 250 was obtained from the Gilligan site. In characterizing the Greenwood phase, Jones and Witty (1980) note that a predominant pottery type, Verdigris type, is the most consistent indicator for cultural identification. A second pottery type, Greenwood type, has also been identified at several Greenwood phase sites. As Jones and Witty note (1980:121), the vessel form of the Greenwood type is quite similar to Pomona ware (Wilmeth 1970) of the Middle Ceramic period. Large stemmed projectile points with expanding stems and moderate to pronounced barbs and smaller projectile points with the same configuration are a part of the lithic inventory of the Greenwood phase (Jones and Witty 1980:122). Other chipped stone artifacts associated with the phase include thin biface knives and unifacial scraping tools. Shell beads, pendants, and imitation conch shell pendants are reported from Greenwood phase sites as well as tubular bone beads, bone awls, and other utensils.

In discussing the Greenwood phase, Witty and Jones note that "The settlement pattern for the Greenwood phase consists of small and moderate sized habitation sites of some duration located adjacent to dependable streams..." (1980:122). Habitation structures of some permanence are suggested by incomplete posthole patterns found at the Curry, Two Dog and Cow-Killer sites. Oval or round houses are indicated with at least a partial covering of clay daub plastered over thatched grass. Smaller sites of Greenwood phase peoples are also known, though incompletely investigated (Jones and Witty 1980:122). At one site, the Curry site, a cemetery complex was associated with

the Greenwood phase component. An adult female and the skeletons of several children were discovered in the flexed and semi-flexed positions (Calabrese 1967).

One thing that is clear for the Early Ceramic period is that a sizable population expansion took place during this time, as is evidenced by an increase in both the number and size of archeological sites over the preceding archeological periods. Of the total number of recorded sites within the state in the files of the Kansas State Historical Society for which some cultural identification can be made, the Middle Woodland and/or Plains Woodland sites outnumber almost two to one any other single major cultural unit. The density of material at many of these sites indicates that they were occupied over longer periods of time than in the Archaic, which perhaps reflects a move toward a more sedentary existence, possibly associated with incipient agriculture. Very little direct evidence of Early Ceramic agriculture has been found in Kansas, however. Cultigens, corn and possibly sunflower, have been recovered from a pit in a Cuesta phase house floor at 14LT304, a site in the proposed Big Hill reservoir in southeast Kansas (Rowlison 1977:42), and corn and beans have been reported from excavations at the Kansas City Hopewell Renner site in present day Kansas City, Missouri (Wedel 1943). It appears that hunting and gathering comprise the basic subsistence economy and that agriculture, if present, was of minimal importance (Reynolds 1979).

The Middle Ceramic Period

By circa A.D. 800 to A.D. 1000, cultural groups were living in Kansas that, at least in some areas of the state, relied more heavily upon agriculture and lived in even more stable and sedentary habitations than had the previous Early Ceramic period cultures. This is known archeologically as the Middle Ceramic period and it is also sometimes referred to as the Plains Farmer period, due to the archeologically documented presence of domesticated plants such as corn, beans, and squash, and tools associated with horticulture. Middle Ceramic period culture complexes relevant to the Melvern lake area include the Pomona focus (Witty 1967, Wilmeth 1970), the Clinton phase (Johnson 1968), and the Central Plains tradition (Gradwohl 1969; Brown 1966; Krause 1969).

The Middle Ceramic lithic tool inventory includes both chipped stone and ground stone artifacts. Projectile points are typically small, thin, triangular points with single or double side notches and occasionally single base notches, although significant numbers of larger corner notched and stemmed points are also found at Pomona focus sites. Knife

forms are generally triangular, although the diamond-shaped, alternately beveled knife is fairly common. Celts are usually of the chipped variety, but occasionally exhibit minor grinding (Thies 1980:19). Grinding slabs, mullers, grooved arrow shaft smoothers, etc. comprise the ground stone tool inventory. Few bone or shell artifacts have been reported for Pomona focus sites. This may be due to climatic factors and the basically acidic soils of eastern Kansas. Bone artifacts are much better represented in the Central Plains tradition and include such diverse items as beamers, fleshers, rib shaft wrenches, awls, bison horn core scoops, deer mandible graters, a variety of digging tools made from bison scapulae, scapula hoes, cleavers or spatula-like forms, modified dorsal bison spines, bone arm bands, and socketed bison tibia digging stick tips (Witty 1978: 57-58).

The artifact inventory of the Middle Ceramic period cultural complexes includes small to large sized globular-shaped ceramic jars with all over cord-roughening. Rims are generally straight or outwardly flaring in form although a significant number of thickened or channeled collared types are also present (Thies 1980:19). Middle Ceramic vessels usually have well defined necks and prominent shoulders and ceramic decoration is lacking or minimal, consisting of occasional tool impressed, notched lips found on Pomona and Smoky Hill pottery, or pinching around the lower edge of the collar seen on some Smoky Hill vessels (Thies 1980:19). Tempering material is quite varied. Indurated clay and/or sand was commonly utilized by Central Plains tradition potters, while apparently indurated clay (weathered shale particles), crushed sherds, or occasionally, crushed bone was utilized by Pomona focus peoples. Indurated clay consists of naturally occurring angular and irregularly shaped particles of weathered shale which can range in color from dark gray to reddish yellow and which exhibit a considerable range of hardness. Some particles appear to be harder than the surrounding paste while others are softer. Crushed sherd temper consists of clay particles which can exhibit the same range of form as indurated clay in terms of shape, color and hardness. They, however, are a tempering material which has been intentionally added to the raw potter's clay. It is virtually impossible to distinguish between the two visually unless one is fortunate enough to have crushed sherd particles which are themselves tempered with foreign aplastics or which exhibit an original surface treatment.

In Kansas, the Central Plains tradition is spatially limited, by and large, to portions of northeast and north central Kansas along the Kansas and Missouri river drainages. The Central Plains tradition is represented in Kansas by the Smoky Hill aspect or phase (Wedel 1959:535, 563-566), the Upper Republican phase and the Nebraska phase (Brown 1966:294-301 and Lippincott 1976, 1978).

The Nebraska phase is concentrated in the extreme northeastern part of Kansas (Ashworth 1981:1), the Smoky Hill phase in central and north central Kansas and the Upper Republican phase in extreme north central Kansas and western Kansas. Temporally, radiocarbon dates ranging from A.D. 1138 to A.D. 1458 have been reported (Wedel 1961:100), although Lippincott (1976, 1978) has indicated that at least the Upper Republican phase may date back to perhaps as early as A.D. 800.

The Central Plains tradition is characterized by often found remains of substantial earth covered dwellings of frame construction, usually square to rectangular in floor plan, with long, covered entrance passages. The heavy roof of the earth lodge structure was supported by four or more widely set center posts and usually contained a centrally located hearth. Earth lodges associated with the Nebraska phase are commonly semisubterranean, with the floor placed from 2 to 5 ft below ground. In the Smoky Hill and Upper Republican phases, such pits were usually shallow or entirely lacking. In the Central Plains tradition, houses were commonly distributed in what has been termed a rural hamlet pattern; consisting of single houses, randomly scattered at intervals of a few yards to several hundred feet, or of clusters or single units. Gradwohl noted the occurrence of small nucleated villages for the Nebraska phase (1969:135). Larger settlements are represented by the Minneapolis site of the Smoky Hill phase which represents an earth lodge village of some 24 houses (Witty 1978:57) and by some Upper Republican sites in north central Kansas (Lippincott 1976). Little or no evidence of settlement planning is apparent for the Central Plains tradition, with the lodges being strung out irregularly along the tops of ridges, bluffs, and terraces or close to creek bottoms and ravines where horticultural activities apparently took place (Thies 1980:17). The basic settlement pattern also includes small campsites, lacking house remains, that occur on flood plains as well as on ridge tops overlooking valleys.

The Pomona focus is located adjacent to the Central Plains tradition area, but it is identified as being culturally distinct from the Central Plains tradition (Witty 1967, 1978:59-64). Pomona focus sites are concentrated in the east central portion of Kansas, primarily in the Osage Cuestas and the eastern Flint Hills, but also occurring in the Dissected Till Plains north of the Kansas river. Temporally, Pomona focus sites have yielded radiocarbon dates from A.D. 1000 to A.D. 1600 (Witty 1967:4, 1978:62). A major determinant of Pomona focus are the archeologically encountered remains of one or more structures which had been covered with thatch and plastered over with clay. These were relatively light weight structures, roughly oval in shape and usually about 25 ft long

and 15 ft wide (Thies 1980:18). Structural indications include irregularly and sometimes widely spaced postmolds as well as considerable fired, grass and pole impressed daub. Major portions of these structures were apparently plastered over with clay, judging from the abundance of grass impressed and pole impressed fired clay daub found at these sites. Features identified as interior hearths are usually lacking in Pomona structures (Witty 1967:2, 1978:60). In terms of the settlement pattern, Witty suggests that extended community relationships are indicated, with single or paired houses, occasionally even up to four houses, situate¹ along low terraces or on natural levees on the valley floor from a few hundred yards to almost a mile apart (1978:60). As was noted for the Central Plains tradition, the Pomona focus settlement pattern includes smaller campsites on flood plains and on ridge tops. These apparently represent temporary camps associated with food gathering activities or specialized work areas (Thies 1980:18).

The Clinton phase, an archeological manifestation defined by Johnson (1968) on the basis of sites excavated in the Clinton reservoir area of eastern Kansas, is evidently quite closely related to the Pomona focus. Johnson notes that the settlement pattern consisted of isolated houses located on slight rises on the first terrace above small watercourses (1968:134). Houses, while somewhat incompletely represented, were interpreted to be simple pole framework structures with a covering of wattle and daub (Johnson 1968:134). Interior house features included shallow, circular, basin-shaped or undercut storage pits and, occasionally, basin-shaped interior hearths (Johnson 1968:134). Subsistence included hunting and gathering and corn cultivation (Johnson 1968:134). The ceramic inventory included both globular vessels and shallow bowls, both of which had exterior surface finishes ranging from cord marked to smoothed (Johnson 1968:134). Tempering additives were typically of clay or shale particles although angular grit and shell temper were also noted in the sample (Johnson 1968:134-135). Chipped stone implements included plain triangular, side notched triangular, and side and basal notched triangular projectile point forms as well as knives, scrapers and celts (Johnson 1968:135). Ground stone implements included celts, handstones, grinding slabs, and probably stone elbow pipes (Johnson 1968:135). No radiocarbon determinations are available for the Clinton phase although Johnson suggests a dating in the period from A.D. 1000 to A.D. 1500.

Other Middle Ceramic period cultural complexes occurring in eastern Kansas, but not yet identified in the Melvern lake area, include the Steed-Kisker complex from northeast Kansas and northwest Missouri and the Neosho focus of southeast Kansas (Wedel 1959).

The Late Ceramic Period

The Late Ceramic period represents the bridging of the prehistoric period with the advent of written history, i.e., the arrival of Europeans and Euro-American exploration and settlement (Witty 1980:11). The temporal dates for the Late Ceramic period range from approximately A.D. 1500 to A.D. 1800 and thus both protohistoric and historic groups are represented. The Late Ceramic period thus represents a time just prior to, during, and after the initial contact with the first Europeans. The Protohistoric is important in being the first period in which recorded history can be used to identify archeological manifestations with historic tribal groups (Thies 1980:21). Witty (1980:11) notes that the Late Ceramic period, in general, is marked by an increase in gardening efficiency and a marked increase in dependence on bison hunting which allowed populations to nucleate in large villages in the Central Plains. In central Kansas, this period is represented by sites of the Great Bend aspect which have been identified as settlements of the protohistoric Wichita bands (Witty 1980:11). These people built large, dome-shaped houses covered with thatched grass, and have been identified as the Quivira peoples sought by Coronado (Wedel 1959). Great Bend aspect materials have been recovered from the Toronto reservoir area to the south of Melvern lake and to the west in the vicinity of Marion, Kansas, in the Flint Hills. In the middle or latter part of the seventeenth century, Siouan-speaking people from the east established villages on the Osage, Missouri, and Kansas rivers (Witty 1980:11). Historically, these people are known as the Osage and Kansa and they are evidently represented prehistorically by the Neosho focus and by Oneota manifestations. Generalized artifact traits of the Late Ceramic are: globular or conoidal, flat based pottery jars with smooth or simple stamped exterior surface treatment; small plain, triangular projectile points, and grooved mauls; the extensive use of bone and antler tools for gardening and digging, as well as hide fleshing and scraping.

HISTORIC PERIOD

The Historic Indian Cultures

The Historic period begins, in Kansas, in A.D. 1541 with Coronado's journey to the "Quivira" villages, identified archeologically as Great Bend aspect and identified culturally as the protohistoric Wichita culture. These villages were reportedly located just beyond the bend of the Arkansas river, and are currently believed to be in the vicinity of Lyons and Lindsborg, where European artifacts and datable

Puebloan pottery sherds have been found in Great Bend aspect sites (Wedel 1959:319-320). By the early 1700s, the Wichita had apparently abandoned their territory in Kansas and had moved far to the south into Oklahoma and Texas. The Caddoan-speaking Wichita were apparently replaced in southeast and east central Kansas by Siouan-speaking groups such as the Kansa and Osage, sometime after the advent of Coronado into the area. By 1792, the Kansa were inhabiting areas along the Kansas river in northeast Kansas where they were identified by the French explorer, Pierre Vial (Wedel 1959:36-37). The Osage, who were earlier located in western and southwestern Missouri, had apparently been forced out of Missouri by the early 1820s, and had resettled along the lower Verdigris river in northeastern Oklahoma and along the Neosho river in present day Neosho and Labette counties of southeastern Kansas (Thies 1980:23). No known sites attributable to either the Kansa or the Osage are known from the Melvern lake area (Aldenderfer 1980).

In A.D. 1825, the reservation era began in Kansas with the signing of treaties between the United States government and the Kansa and Osage tribes (Abel 1904). These treaties sharply restricted the territorial limits of the two tribes, confining the Kansa to a 30 mile wide reservation which extended along the Kansas river. The Osage were confined to a 50 mile wide by 75 mile long strip of land along the Neosho and Verdigris rivers in southeastern Kansas. In 1846, or shortly thereafter, the Kansa were moved to a still smaller reservation near Council Grove. The Osage maintained their reservation land on the Neosho until 1865, congregating after that time in their villages along the Verdigris (Thies 1980:23). In 1872 and 1873 both tribes were finally removed to Oklahoma.

With the placement of the two principal tribes, the Kansa and the Osage, on diminished reservations in 1825, the United States government was free to establish reservations in Kansas for eastern tribes. The largest block of eastern tribes resettled in Kansas were from the Great Lakes region in the Illinois/Ohio area. Predominantly Algonquian speakers, these tribes included the Potawatomi, confederated Sac and Fox, the Miami, Kickapoo, Ottawa, Chippewa and Shawnee. Siouan speakers from Nebraska, Iowa, Missouri and Arkansas comprised another large block of tribes. Included were the Oto, Missouri, Iowa, and Quapaw. The Delaware, a tribe originally from the northeast part of the United States, also received a reservation in Kansas.

In addition to their reservation, they were given a narrow strip of land called the Delaware Outlet which allowed them access to the bison rich High Plains to the west. A few New York tribes were given small reservations in Kansas and one southeastern group, the Cherokee, was given land.

It appears that the Melvern lake area lies within the boundaries of two immigrant reservations. Abel (1904: 82 and accompanying map) indicates that this portion of the Marais des Cygnes river was within the boundaries of a Potowatomi reservation that was established by an 1837 treaty between the Potowatomi and the United States government. Abel reports that the Indians occupied this reservation for about ten years until they moved northward to the second Potowatomi reserve in 1847 and 1848. Documentation for the actual habitation of this area by the Potowatomi during the period from 1837 to 1847 is lacking at this time, although Clifton (1977:287-288) suggests that a portion of the Mission band of the Potowatomi inhabited lands along the Marias des Cygnes river within that period. Aldenderfer, in his cultural resource management plan for Melvern lake, Kansas, apparently found no substantiation for the Potowatomi occupation of this area, as he suggested that the Melvern project area was not directly occupied by any Indian groups during the period from 1834 to 1846 (1980).

The second immigrant group to occupy the general area of Osage county were the Sac and Fox of Mississippi (Abel 1904:85). Apparently the Sac and Fox Indians were occupying a reservation at the headwaters of the Marais des Cygnes river by 1845 and 1846 (Abel 1904:85; Aldenderfer 1980:22). Ferris (1910) indicates that the Melvern lake area was well within the Sac and Fox reservation in the period from 1846 to 1864 and this is supported by Andreas (1883:1529-1530) and Wilmeth (1958:7). Removal of the Sac and Fox from this area apparently occurred in 1868-1869 although the whites had begun to settle in the area previous to this (Aldenderfer 1980:24). Aldenderfer (1980) found no evidence which would indicate that the Sac and Fox habitation took place in the actual vicinity of Melvern lake, although it is certainly a possibility.

The immigrant tribes who inhabited eastern Kansas in the period after 1825 were primarily horticulturalists, adapted to a Woodland way of life. In Kansas, several of these groups became proficient in bison hunting, and some obtained notable stature in Plains style warfare in conflict with indigenous tribes of the western Plains. Many of the immigrants, however, maintained well kept Euro-American style farmsteads complete

with log cabins, fenced fields, and domestic animals. Public sentiment and governmental policy caused the removal of most of the immigrant tribes from Kansas by the late 1860s. Most of these groups were removed to present day Oklahoma except for remnants of the Potawatomi, Kickapoo, Iowa, and Sac and Fox tribes, some of whose descendants remain in Kansas to the present day.

The Euro-American Settlement

The earliest known historical accounts dealing with Kansas are those of the Coronado expedition of A.D. 1541. In the succeeding 150 or so years, a number of other Spanish exploratory expeditions visited the Kansas region (Wedel 1959). There is no indication that the early Spanish explorers visited the area of eastern Kansas where Melvern lake is situated.

Following the early Spanish exploratory expeditions from the Southwest, the French entered the area from the east, by way of the Great Lakes and the Mississippi valley. The early French documents concerning the Kansas region are vague and generalized, which makes it uncertain just when the westward penetration began and how extensive it was (Wedel 1959:26). The somewhat later French expeditions of Claude Charles du Tisne in 1719 to southeastern Kansas and northeastern Oklahoma and the 1724 expedition led by Etienne Veniard de Bourgmond document the appearance of the French in this area during this early period (Thies 1980:26; Reichart 1978:41). The consummation of the Louisiana Purchase in 1803 transferred the vast Louisiana territory to the United States and from that time on, exploration of the Central Plains was more systematic and better recorded, with Americans acting as the primary participants.

Zebulon Pike apparently led one of the first of the American expeditions to travel through the interior of Kansas (Thies 1980:26). Pike's 1806 journey apparently took him across portions of southeastern Kansas and through the Flint Hills region, crossing the Neosho, Verdigris, and Cottonwood rivers and their headwaters. We have no documentation for his presence in the vicinity of Melvern lake however.

By the early 1800s, Euro-American settlement of this eastern Kansas region had begun. Most were hunters, trappers, or traders and the Santa Fe Trail, surveyed in 1825-1827, was apparently a major attraction (Thies 1980:27). The arrival of immigrant tribes in the area in the period after A.D. 1825 delayed the white settlement of the area, although the Euro-American encroachment upon tribal lands and resources

was a constant and increasing problem over the next several years. The first well documented description of the Melvern area was by Isaac McCoy in 1828 (Barnes 1936). McCoy, under the direction of the United States government, was to survey for Indian lands for new reservations in portions of eastern Kansas in that year. McCoy apparently traveled along the Marais des Cygnes river, passing through much of the valley. Wilmeth (1960) indicates that McCoy traveled on the north side of the Marais des Cygnes and therefore he may have been very close to the vicinity of the Cow-Killer site.

In 1854 the Kansas territory was established and in 1859, when Osage county was organized, the western part of the Sac and Fox reservation was ceded (Wilmeth 1959:7). This apparently included all of the Melvern reservoir area (Wilmeth 1960:7). Kansas was admitted as a state in 1861, the same year that the Civil War started. During this period, refugee Creek and Cherokee Indians from the Oklahoma area were apparently temporarily located on Sac and Fox lands (Wilmeth 1959:7). After the Civil War, in 1867-1868, the remainder of the Sac and Fox reservation lands were ceded and this area was soon occupied even more intensively by white settlers. The primary economic activity in the Melvern lake area since that time has been for agriculture, with mining, quarrying, etc., playing a relatively minor role and with settlements of only small size.

PREVIOUS ARCHEOLOGICAL INVESTIGATIONS IN
THE MELVERN LAKE AREA

In the last quarter century a total of 35 prehistoric and historic archeological sites have been identified within the Melvern lake area and five additional sites have been located on private lands adjacent to the Melvern lake project boundaries (Aldenderfer 1980:12). The majority of these sites were located, and some were tested and excavated, as a result of four federally funded archeological surveys and three federally funded programs for excavation and mitigation of adverse impacts at selected sites (Aldenderfer 1980:12) and every survey conducted within the reservoir area has yielded additional previously unknown archeological site locations. It is evident that the reservoir area still has considerable potential for yielding significant archeological remains.

Prior to 1957 no known archeological sites were recorded in the files of the Kansas State Historical Society for the Marais des Cygnes river in the vicinity of Melvern lake. The initial archeological survey of the Melvern lake area was conducted by Roscoe Wilmeth, then of the staff of the Kansas State Historical Society, through an agreement between the Society and the National Park Service and its coordinating agency, the Interagency Archeological and Paleontological Salvage Program. The survey was conducted concurrently with one of Pomona lake, located north of Melvern lake. Wilmeth spent a total of 15 days conducting a reconnaissance of the two proposed reservoir areas and his research was limited to surface collections and interviews with property owners. He recorded a total of nine archeological sites in the vicinity of the Melvern reservoir area and he recommended additional testing for all sites (Wilmeth 1959). Cultural affiliations for the nine sites were difficult to determine at that time but it seems clear from Wilmeth's manuscript that he recognized the presence of Middle and Early Ceramic period sites, possible Archaic components, and one possible protohistoric site (Wilmeth 1959).

The second major archeological work conducted at the Melvern lake area was carried out in 1962 under the overall direction of Carlyle S. Smith of the University of Kansas with Walter H. Birkby as the excavation supervisor (Smith and Birkby 1962a, 1962b; Moore and Birkby 1964). The project was jointly authorized by the Interagency Archeological and Paleontological Salvage Program of the National Park Service and the Missouri Basin Project of the Smithsonian Institution (Aldenderfer 1980: 18). Six of the sites previously discovered by Wilmeth were reinvestigated during the 1962 investigations and four new sites were discovered. Major excavations were conducted at sites

140S1, 140S312 and 140S314. 140S1, the Turkey Creek site, was attributed by Moore and Birkby (1964:65) to the Archaic period. Archeological site 140S312, the Wiley site, was discovered to be a possible three component site with Archaic, Woodland and Central Plains materials being uncovered both on the surface and in excavations (Moore and Birkby 1964). Interestingly, the Wiley site, the most extensively investigated of the Kansas University sites during the 1962 field season, was located approximately one mile west of site 140S347, the Cow-Killer site. The Kansas University crew was unable to discern any meaningful vertical stratigraphy delimiting the three components although there was at least a suggestion of a horizontal separation of different areas within the site that contained materials attributable to one or more components. Area E, one of the areas delimited by the Kansas University excavators, apparently yielded burned limestone tempered ceramic materials that are similar to the Verdigris ware sherds that were associated with the Plains Woodland occupation at the Cow-Killer site (Logan 1981). 140S312 was located on the south or right side of the Marais des Cygnes river. In addition to the three possible habitation components at the Wiley site, one excavated area, excavation unit 3, yielded 15 primary flexed burials and associated artifacts that apparently were related to the Middle Ceramic period occupation of the site (Smith and Birkby 1962a: 34-36). It is interesting that, to date, the Wiley site is the only site other than 140S347 in Melvern lake that has yielded materials attributable to the Archaic period as well as to the Early Ceramic period. The third site excavated by the Kansas University crew, the Harsch site, 140S314, yielded evidence of two circular to oval house structures that were at least partially covered with wattle and daub and that also yielded a distinctive type of ceramics that has been since recognized to be typical of the Pomona focus as defined and discussed by Witty (1967, 1978).

During the summer of 1967, a field party from the Department of Anthropology at Kansas University conducted yet another salvage archeological investigation in the proposed Melvern reservoir under the direction of Lawrence E. Bradley (Bradley 1968). This additional survey resulted in the discovery of 13 previously unrecorded sites. Excavations were carried out at four sites, 140S312, 140S3, 140S4, and 140S34 (Bradley 1968). Two of the sites investigated by Bradley have particular importance for our present survey. These include the additional work that was conducted at 140S312, the Wiley site, and the work conducted at 140S3. 140S3 is located approximately one-half mile south of 140S312 and may in fact be an extension of the Wiley site. While the excavations conducted at the Wiley site, 140S312, during the 1967 field season did little to clarify the intersite relationships between the various components, Bradley was able

to demonstrate the presence of both the Plains Woodland and Middle Ceramic period components at the site. Bradley's investigations of the Jones site, 140S3, provided additional evidence for the Middle Ceramic period occupation of the valley. Here, Bradley uncovered evidence of one house structure, House 1, and a considerable body of ceramics which conformed to the previously discussed Pomona focus.

The last archeological survey conducted in the Melvern lake area was conducted by Susan B. Traub in 1974. Traub's work was largely confined to the multipurpose pool and flood pool in the upper reaches of the reservoir and resulted in the location of four previously unknown archeological sites (Traub 1974).

ARCHEOLOGICAL INVESTIGATIONS AT THE COW-KILLER SITE, 140S347

Archeological site 140S347, the Cow-Killer site, is located (Figure 3, Plate 1) on the left or the north side of the Marais des Cygnes river between the old and new alignment of U.S. 75 on the downstream side of the Melvern dam (Figure 3). The site complex is part of an old and low terrace remnant of the Marais des Cygnes river. Steep limestone bluffs define the northern boundary of the site and a cutoff meander of the Marais des Cygnes forms the western boundary. The present river channel, which has been straightened in the past, forms the southern boundary and old highway U.S. 75 forms the eastern boundary. It is possible that the site extends east across old highway 75 onto private cultivated land.

HISTORY OF THE HIGHWAY PROJECT

On June 20, 1969, the Archeology Department of the Kansas State Historical Society received a copy of a public information bulletin from the State Highway Commission of Kansas about a proposed improvement of highway U.S. 75 in Osage county, Kansas. It offered opportunity for a location public hearing on the proposed construction project which was listed as Highway Project 75-70-F-063-3(1) and included with the legal notice was a map indicating a study corridor two miles wide extending from the Osage-Coffey county line north and east 7.5 miles on a new location to connect with existing highway U.S. 75. A tentative alignment was also indicated on the map. At this time the Archeology Department had not yet entered into a cooperative agreement to conduct archeological studies of highway projects but a search of the Historical Society master files revealed that a number of archeological sites that had been located during Wilmeth's initial study of Melvern reservoir area were located within the western portion of the broad highway corridor for new highway U.S. 75.

In late January of 1971, the Society received a copy of a legal notice for a design public hearing on the proposed highway U.S. 75 project. By this time, the proposed project had been narrowed down to a specific highway alignment. The proposed project was to begin at the west junction of U.S. 75 and U.S. 50 and extend north 5.5 miles to one mile east of Olivet and then to proceed northeast to highway U.S. 75, east of the north end of Melvern dam. Included with this legal notice, which was dated January 15, 1971, was a service requisition from the State Highway Commission to determine if any significant archeological sites could additionally be expected within the boundaries of four

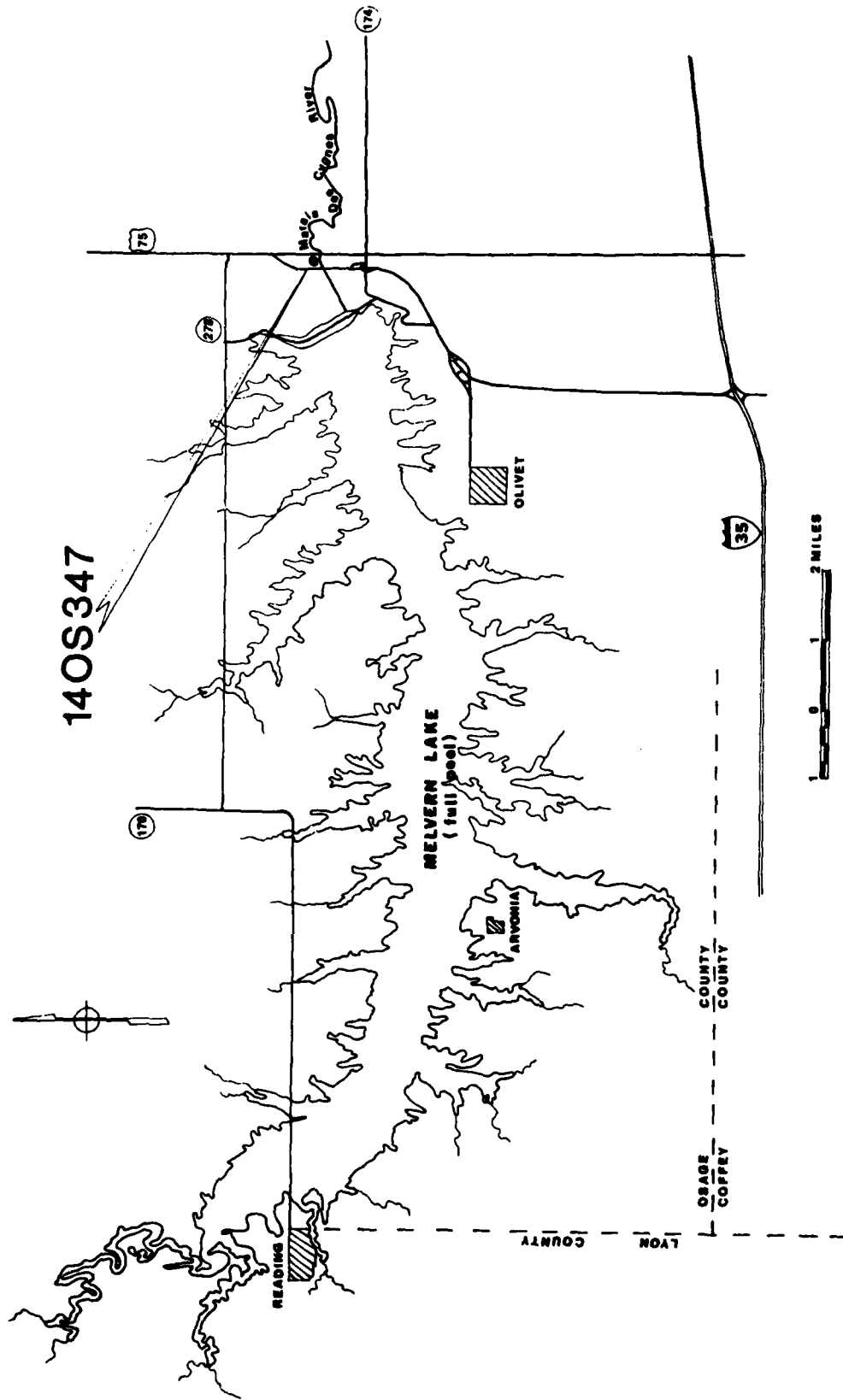


FIGURE 3: Map of Melvern lake showing the location of the Cow-Killer site, 140S347



PLATE 1: 140S347, Relationship of site
to preconstruction environment

prospective borrow areas. One of these borrow areas, Borrow Area Number 4, (originally number 5), included an area that was later designated as archeological site 140S347 (Figure 4).

Shortly after the Society entered into a Cooperative Agreement for Highway Archeological Salvage Program with the SHC in January 1971, an archeological survey of the U.S. 75 project was conducted by John D. Reynolds. The survey methodology consisted of a traditional pedestrian inspection survey of exposed areas and areas of apparent high archeological potential along the proposed highway alignment and in the four prospective borrow areas. A portion of the project area which includes the Cow-Killer site was surveyed on March 5, 1971 by John D. Reynolds. At that time, no archeological materials were noted or observed on the cultivated surface and it was concluded that the area had little potential for yielding archeological information. Reports of this work were submitted to the Highway Commission on March 29, 1971, April 13, 1971 and May 24, 1971. Five previously unknown archeological sites, 140S332, 140S333, 140S334, 140S335 and 140S336 were identified during the archeological survey for this highway project, but all of these sites were located to the south of Melvern lake in the vicinity of Frog creek. Because of the high density of archeological sites in this vicinity, the Society requested additional funds to conduct Phase III testing of selected sites in April, 1971. Of the six located sites, three were excavated and two additional sites were tested (Reynolds 1974, 1975). The excavation of 140S335 revealed the presence of a prehistoric house structure, associated potsherds, lithic tools and debris, bone fragments, etc., suggesting the presence of a Middle Ceramic cultural complex attributable to the Pomona focus (Reynolds 1975).

In December 1973, the Commission informed the Society that some deeply buried concentrations of burned rock had been uncovered on the south side of Frog creek during channel cutting. Witty and Reynolds observed two clusters of burned rock and another area of burned rock and burned earth in this area (Reynolds 1974:9). Frozen soil precluded a more thorough investigation of the site at that time, but Commission personnel and construction personnel agreed to avoid the area until testing had been conducted. On January 30, 1974, Society archeologists returned to the site and completed initial testing. As a result, the Society submitted a request to the State Highway Commission for a Phase IV level Emergency Salvage excavation.

The Phase IV tests were conducted during three weeks in late February and early March by John Reynolds with a crew of four laborers. An extensive test was made to determine the significance of the exposed materials and the cultural levels.

The test revealed that the site had two components; cultural materials were represented sparsely in the first 2 ft of soil, a 1 ft thick culturally sterile zone lay immediately beneath this, and another relatively thick zone of cultural debris was present from the base of the sterile zone to a depth of approximately 5 ft below the original ground surface (Reynolds 1974:9). The upper cultural zone contained evidence of a small limestone lined fire hearth and occasional chert flakes, bone fragments, and pieces of burned earth and wood charcoal. The small, triangular arrowpoint found in this zone suggested that the material dated from approximately A.D. 1000 to A.D. 1500. As reported above, the Society crew had excavated a small structure attributable to the Pomona focus in May of 1971 at archeological 140S335. Archeological site 140S335 was located immediately north of archeological site 140S343 and on the north side of Frog creek.

The second cultural zone, which was found from 3 to 5 ft below the original ground surface at 140S343, yielded significantly more evidence of occupation than did the upper zone. In this lower zone were found a large limestone lined fire hearth, two small basin-shaped and trash-filled depressions, abundant bone fragments, charred seeds, charcoal and burned earth, chipped stone tools, and pottery sherds. The chipped stone materials included chert cores and flakes, knives, scrapers, and stemmed dart points. The recovered ceramics consisted of thick, grit tempered and cord-roughened body sherds which fit the criteria of the Grass-hopper Falls ware (Reynolds 1975). The tests at site 140S343 established the presence of a two component site with both Middle and Early Ceramic components. The test also indicated that the horizontal extent of the site was very restricted and that it contained little additional material of archeological significance. Accordingly, the rechannelization resumed upon the completion of the test and a final report of the investigation was submitted to the State Highway Commission on April 7, 1975.

On July 18, 1974, the recently formed Kansas Department of Transportation informed the Society that a possible archeological site had been uncovered during the removal of fill from Borrow Area Number 4. On July 22, 1974, John Reynolds conducted an inspection of the borrow area and recorded the presence of a multicomponent archeological site, 140S347 in that location (Plates 2 and 3). Reynolds noted that within the limits of the borrow area the soil had been removed to a minimum depth of approximately 3 ft below the original ground surface and to a maximum depth in some areas of 10.5 ft below the original ground surface. During the initial appraisal he noted the presence of limestone lined hearths and isolated rock and occasional animal bone, although no artifacts were encountered. Subsequently, Society archeologists spent six additional days attempting to define and appraise the complex represented at the site.



PLATE 2: 140S347, View to west across highway borrow area



PLATE 3: 140S347, Monitoring of highway borrow removal

The eastern portion of the borrow pit, designated Area 741, yielded several areas of possible archeological significance. These included quantities of bison bone and several possible hearths containing limestone, charcoal, ash, and fragments of burned animal bone. The bison bone was found in a high and apparently noncultural dark humic soil zone. The hearths were located in a deeper brown soil which overlay a light brown clay. One of the hearth areas yielded a chipped stone gouge, chert knife and scraper fragments, chert flakes and cores and quantities of small animal bones (Plate 4). The chipped stone gouge and the nearby find of a stemmed dart point suggested that this component was attributable to the Archaic period and that it was therefore worthy of additional salvage effort.

The west side of the borrow pit yielded information about later cultural components. Here a cluster of burned limestone, charcoal and burned bone fragments, designated Area 742, was found in dark humic soil. This appeared to be the remnant of a small hearth. In a nearby area, which was called Area 743, nine possible postmolds were uncovered which may have once formed a portion of the south and east walls of a rectangular-shaped structure. Severe disturbance of the soil in this area prevented a final determination.

The depth and richness of the cultural deposit in Area 741 indicated that excavation in this area would be worthwhile. The Society requested and was authorized to conduct Phase IV Emergency Salvage excavations at this site on July 31, 1974. Fieldwork began on August 1, 1974 and continued intermittently through September 18, 1974 (Plate 5).

On August 27, 1974, the Society formally notified the Kansas Department of Transportation that the Cow-Killer site had proved to be so significant that it was eligible for nomination to the National Register of Historic Places. This nomination was prepared and submitted and, on June 24, 1975, the Cow-Killer site (140S347) was entered on the National Register listings. While conducting tests and monitoring fill removal, the Society learned that the Corps of Engineers planned to construct two sewage stabilization ponds to the southwest and outside of the State's borrow area. Informal monitoring of the fill removal was conducted to aid in a determination of the horizontal extent of site 140S347 (Plate 6). During this occasional monitoring operation, the occurrence of archeological materials was noted within the pond area, called Area 751, but the rapidity with which the pits were constructed precluded a recognition of the thickness and extent of the cultural deposit contained in this area. Monitoring activity conducted in the adjacent borrow area had revealed the presence of scattered small concentrations of archeological materials, consisting of isolated limestone lined



PLATE 4: 140S347, Cross-sectioned hearth (Feature 21), uncovered by highway borrow removal



PLATE 5: 140S347, Area 741, Excavation unit A viewed to west

fire hearths, small concentrations of animal bone, etc., as well as materials of noncultural origin, such as burned tree stumps with considerable amounts of burned earth surrounding them. Until this time, the only area within the site that had yielded evidence of a relatively thick and undisturbed cultural zone was at the eastern edge of the borrow pit, Area 741, at a much greater depth, where testing activity was concentrated during August and September. Upon recognizing that a considerable amount of archeological material had apparently been contained within the stabilization pond area, limited testing was conducted to determine the depth and richness of the cultural fill.

Since highway funding could not be utilized in testing this area, Kansas Anthropological Association members volunteered their assistance in testing the site. The Corps of Engineer's construction engineer at Melvern lake granted permission for the work and on September 7, a day of testing was conducted in the stabilization pond area with a crew of 17 volunteer laborers. The testing consisted of placing two 5 ft by 10 ft squares along the sloping sides of the central dike that separated the two stabilization ponds as well as smaller scale testing along the sloping berm in other areas of the stabilization ponds. This revealed the presence of a thick cultural zone that contained abundant burned earth, charcoal, burned grass impressed daub, as well as pottery sherds, projectile points, other lithic tools, and considerable broken animal bone (Plate 7). The presence of abundant grass and pole impressed burned daub suggested the presence of one or more houses within the occupation zone and the diagnostic cultural materials recovered suggested a Plains Woodland cultural affiliation.

The September 7 testing of the stabilization pond area marked a critical point in the investigations of the Cow-Killer site. It had earlier been determined that Area 741 contained evidence of a deeply buried and still partially undisturbed Archaic component and it was recommended that this area be preserved. This was accomplished by curtailment of further highway borrow removal and covering and grassing of that area. The remaining portion of the borrow area contained scattered, isolated hearths and artifacts, some of which were Archaic, but others were indicative of more recent cultural components. None of these other findings was definitely associated with an intact zone of occupation. Monitoring of fill removal was conducted when potential archeological materials were encountered. The find spots were flagged and construction personnel avoided these areas until rapid evaluations could be completed. Several deeply buried, but naturally occurring, burned tree stumps were thus encountered as well as the partially articulated skeleton of a large herbivore which had apparently died of natural causes. In addition, isolated hearths, rock concentrations, and artifacts that were encountered were rapidly salvaged.



PLATE 6: 140S347, Area 751, Monitoring of Corps of Engineers stabilization pond construction



PLATE 7: 140S347, Area 751, Test excavation in central dike of stabilization pond area

The stabilization pond area was felt to be particularly significant because it provided the first indication of a buried Woodland occupation zone of some complexity at the Cow-Killer site. The Kansas City District, Corps of Engineers was contacted about the importance of the archeological findings in that area. Plans for preserving the intact portion of the Archaic zone in Area 741 were also discussed.

In a letter dated August 27, 1974, Thomas A. Witty, Jr., State Archeologist, reported the initial findings at the Cow-Killer site to the Corps of Engineers. Witty noted that the site was a multicomponent site and concluded that the site met National Register of Historic Places criteria for eligibility. He further indicated that he intended to make the appropriate nomination of this site to the Kansas Historic Sites Board of Review. On October 8, 1974, the Corps of Engineers informed Witty by letter that all further construction activity in the area of the stabilization ponds had been delayed for ninety days and that the Kansas Department of Transportation had been requested to have its contractor return the top soil to the borrow pit without any further scraping of the bottom or sides of that pit. At this time, the Corps requested that the Society submit a proposal and budget estimate for the complete excavation and salvage of all remaining materials in the dike area between the two stabilization ponds. Accordingly, on October 18, 1974, Witty submitted a cost estimate and supporting data for the proposed Emergency Salvage archeological purchase order between the Corps of Engineers and the Kansas State Historical Society to conduct the needed research. The purchase order was issued 30 days later and resulted in further delay in completion of construction of the stabilization ponds, as the necessary archeological salvage investigations could not be conducted during the winter.

On November 21, 1974, Thomas A. Witty and John Reynolds from the Society met with Corps of Engineers and Neosho Construction company personnel at the stabilization pond area to determine a feasible area in which a proposed connecting trench could be placed. Testing revealed that the connecting trench could safely be placed 20 ft to the south of the center of the dike area. The next day, the construction company placed stakes for a 2 ft wide trench in the area specified and began cutting the trench from east to west across the dike. Society archeologists monitored the trench cutting and the construction company was asked to stop frequently so that it could be studied more closely (Plate 8). The exposed cultural zone was a 1 ft thick dark band of soil extending through the dike and cross-sectioned at a depth of approximately 5.25 to 5.75 ft below the very top of the dike. This zone contained flakes of charcoal, burned earth, chert flakes, a pottery sherd, a triangular point, burned and unburned limestone



PLATE 8: 140S347, Area 751, excavation of connecting trench between the stabilization ponds



PLATE 9: 140S347, Area 751, midden (Feature 127) discovered in backhoe trench

and additional stone debris. As expected, the zone became richer to the west and in this area a midden was encountered which contained burned and unburned limestone, chert flakes, bone fragments, and a tubular bird bone bead (Plate 9). The results of this preliminary work confirmed our hypothesis that the cultural zone extended through the dike area.

Because it was potentially eligible for the National Register, archeological work at the Cow-Killer site could not proceed until a Memorandum of Agreement was signed. On May 30, 1975, the Advisory Council on Historic Preservation approved the Memorandum of Agreement and the needed excavation could proceed. Parties to this agreement included the Advisory Council on Historic Preservation, the Corps of Engineers, and the Kansas State Historic Preservation Officer.

It was learned in February of 1975, that the Kansas Department of Transportation had plans to plant trees in the borrow area where 140S347 is located. The Kansas State Historic Preservation Officer, the State Archeologist, the Corps of Engineers, and the Kansas Department of Transportation agreed that the extant portions of archeological site 140S347 could best be preserved by maintaining a grass cover and that no tree plantings could be allowed.

During the period from April 7 to May 16, 1975, an archeological field party from the Kansas State Historical Society conducted the needed salvage investigations of site 140S347. The project, supported by a purchase order from the Kansas City District, Corps of Engineers, was under the direction of Thomas A. Witty, Jr., State Archeologist. The field investigations were conducted by John D. Reynolds, Conservation Archeologist, with the assistance of Ernest E. Carr, field Foreman and a crew of laborers hired from the Topeka and Lyndon, Kansas, areas.

RESEARCH ORIENTATION

The research orientation for the archeological investigations at site 140S347 underwent several changes during the period from July 18, 1974, when the Society was first informed of the existence of the site, until May 16, 1975, when formal field investigations were completed. The early investigations were dictated by the Cooperative Agreement for Highway Archeological Salvage program (State Highway Commission of Kansas and Kansas State Historical Society 1971). In particular, Section 4 of the Agreement permits emergency investigations of archeological sites which are discovered after highway project construction has commenced. Such studies obviously are concerned with an inductive approach, at least initially. Society archeologists

initially spent seven days investigating site 140S347 in an attempt to verify the site's existence and to determine the cultural affiliation and extent of encountered materials. At the end of this first stage of the investigations, it was determined that archeological materials were present within the active borrow pit and that it was necessary to enact Phase IV of Emergency Salvage investigations to provide additional data for an evaluation. All of the investigations performed by the Society in conjunction with the borrow pit were designed simply to test the nature of the archeological deposits. Specifically, this work was not designed nor implemented as a full scale archeological salvage excavation. In fact, upon realization of the significance of the buried Archaic component, further testing was curtailed and the portion of the site within the borrow pit was covered with sod and planted to grass.

During the early testing of the Cow-Killer site, the deposits were an unknown entity and the investigation was simply to conduct controlled limited excavations and monitoring activity in the areas of the borrow pit which were yielding archeological information. By the time that purchase order negotiations were underway with the Corps, the site had been tested more extensively and more was known about the archeological values that were contained here. Witty's October 18, 1974 letter to the Corps clearly indicated the need for mitigation of adverse effects upon the extant archeological remains at 140S347. This letter addressed two different types of mitigation for the affected remains. For the Archaic zone, located in the borrow pit, Witty suggested complete preservation of the extant portions of the zone by curtailment of further borrow removal and by covering the remaining portions of the zone with top soil. For the Plains Woodland zone, located in the stabilization ponds area, Witty recommended mitigation through the complete excavation of all archeological materials located in the earthen dike that separated the two stabilization ponds. He noted that construction plans available for the stabilization ponds would entail further direct destruction of portions of the site and its secondary deterioration by sewage contamination would further endanger the remains when the stabilization ponds were put into operation. While Witty's letter and the reciprocating purchase order from the Corps indicate a few elements of the research design for the archeological work in the stabilization pond areas, they do not fully reflect the problem orientation of the approach. Testing of the Plains Woodland component in the stabilization pond area had suggested that certain methodological approaches for excavating the site might yield information of a problem solving nature. Specifically, the Greenwood phase of the Plains Woodland, with which the Plains Woodland materials at the Cow-Killer site seemed to be most closely allied, was a little known cultural entity at the time of these investigations. It was felt that controlled archeological excavation of this component could reveal information important in delimiting the spatial, temporal, and formal elements of the Greenwood phase.

The finding of possible structural elements at the Cow-Killer site, as evidenced by the burned grass and pole impressed daub, indicated that the site contained evidence of one or more house structures attributable to the Plains Woodland period. It was thus anticipated that the Greenwood phase component could yield information of a structural nature that would augment our knowledge of the settlement pattern within the Plains Woodland. The early tests had further indicated that the Greenwood phase component in the stabilization pond area contained abundant and fairly well preserved faunal remains in association with the structural remnant and with Greenwood phase artifacts. Data concerning subsistence patterns during the Plains Woodland is of vital importance for our understanding of this cultural development and it has seldom been found in eastern Kansas. It was anticipated that careful excavation combined with flotation and waterwashing of soil samples as well as collection of larger materials by standard archeological techniques would add considerable data to knowledge of the Plains Woodland subsistence pattern. As demonstrated in this report, these key elements, along with several other elements that were not recognized until excavation was under way, played a role in the research design.

METHODOLOGY

Specific areas of archeological interest were designated either as areas or as individual features. An area was a location within the site where a complex of presumably related cultural materials were identified. Area designations are convenient units for horizontally separating materials within a broad site area. Areas are numbered by utilizing the last two numerals of the current year (i.e., 74) and then adding individual designators (i.e., 741, 742, 743, etc.) in the order in which the areas are assigned. Thus, at the Cow-Killer site a total of seven areas were designated during the initial field investigations in 1974. During 1975 additional work was conducted at 140S347 for the Corps of Engineers and at this time one of the previously defined areas, Area 745, was redefined as Area 751 (Figure 5).

Feature designations were utilized as identifiers for any notable observation or find in the site area. Thus, artifacts such as isolated points, potsherds, bone fragments, etc., as well as pits, postholes, complexes of rock, bone, shell, soil discolorations, etc., could be awarded feature status. Such status prompted their individual recording upon prepared record forms. The designating of these materials as separate features allowed easy maintenance of the specific locational information for each find. Features were not numbered consecutively. Instead, each feature was given the number of the record page upon which it was recorded. The record forms from the Cow-Killer site comprise a set of consecutively numbered pages, as the pages of a book. The numbered pages were used in sequence as the dig

progressed. For instance, record sheet number 6 might consist of a daily progress record of activities that took place at the site while record sheet number 7 might comprise an identified feature. Similarly, record number 8 might identify a newly defined area within the site. This system obviously does not have consecutive numbering built into it in terms of features, areas, or progress reports, as do many systems, but it does have the advantage of providing a convenient indexing between feature and record. Later triplication of all the field notes from the Cow-Killer site allowed for one set to be filed by record number, a second by subject, and a third by day. The majority of the assigned features at 140S347 were identified within one of the seven designated areas, but in a few cases features were used to mark isolated find spots of artifacts or complexes of artifacts within the general site area.

Vertical and horizontal control of materials found within the site were obtained using standard measuring devices such as a 100 ft steel tape, line level, engineer's eye level, stadia rod, alidade, and plane table. The use of the English system for measurements during the excavations was unfortunate, but was necessitated by the equipment utilized at that time. The rapid removal of soil zones by construction equipment, particularly during the initial testing phase of excavation at the Cow-Killer site, precluded precise measuring for some of these materials. However, after the Emergency Highway Salvage dig began on August 1, 1974, better control was maintained, particularly in Area 741 which was the focus of work at that time. Even tighter control was maintained in Area 751 during the Corps' investigations since by that time construction equipment was no longer present.

Area 741 was the only area within the site where any long term excavation was undertaken in 1974 and consequently this was the only area within the site where a formal grid was established at that time. In Area 741 a series of 5 by 5 ft squares were established which were oriented northwest to southeast. This orientation of the squares was a result of the borrow removal, since the construction equipment was moving in a southeast to northwest pattern and Area 741 consisted of a long linear raised area when it was first investigated by the Society. The south corner of one of the squares within Area 741 was arbitrarily designated as northwest 1000/northeast 1000 and this then became the square designation for that 5 by 5 ft unit. The square immediately to the northwest of this square was then designated northwest 1005/northeast 1000 from its south corner stake. This allowed us to open squares in any direction and immediately have them referenced to an existing grid system. Each of the 5 by 5 ft squares was then excavated by 0.5 ft thick levels or, in some cases, where the richness of fill was considerable, by 0.25 ft thick

levels. Nondiagnostic artifacts, bone fragments and miscellaneous stone, were then sacked by the 0.25 or 0.5 ft thick levels for each square. Diagnostic artifacts, recognizable bone sections, complexes of rock, bone, etc., and soil discolorations were assigned feature numbers and recorded and sacked accordingly. Feature pins were placed to mark the horizontal find spots of features and these were later mapped using a plane table and alidade. Vertical control in Area 741 was maintained by designating one of the 2 by 2 inch wooden corner stakes as Datum 22 and measuring all finds from the top of this stake with a line level placed on a chalk line. The southwest corner of excavation unit northwest 1005/northeast 1015 was chosen as Datum 22 because of its stability. Samples of fill from pits and hearth areas were collected and later subjected to flotation and water-washing.

The methodological approach utilized in Area 751 was basically identical to that of Area 741 in terms of record keeping, feature designation, etc. The formal grid system varied from that of Area 741 in that the excavation units received individual numbers (i.e., excavation unit 1) instead of the previously utilized coordinate grid system. This was done for convenience, as it would have been difficult to plot exact coordinates in relation to Area 741 during the later field investigations. Grid stakes in Area 751 were 2 by 2 inch wooden stakes of 18 inch length and all features were vertically located by referencing to the top of the appropriate southwest corner stake. Subsequent mapping of all grid stakes and features with the plane table and alidade allowed for precise horizontal and vertical plotting of the imposed grid and encountered materials. The grid pattern in Area 751 was set up on magnetic north-south line.

SITE DESCRIPTION

The Cow-Killer site occupies an approximately 17 acre area on the north side of the Marais des Cygnes river just east of old Highway U.S. 75 (Figure 4, Plate 1). The entire field which contained State Highway Borrow Area Number 4, was initially designated as archeological site 140S347 (Figure 4, and Plate 1). Also included in this site unit designation was an area to the southwest of the borrow area where the U.S. Army Engineers constructed two stabilization ponds for Melvern lake facilities. As indicated earlier in this report, the possibility exists that archeological site 140S347 has an even greater areal extent, as it may extend east across old highway U.S. 75 on private land.

Area Designations

Area 741 was an area designated at the eastern side of the borrow pit (Figure 5). Portions of this area were apparently destroyed during fill removal. Also it apparently extended into the eastern side of the borrow pit where no fill had been removed. In any case, the area was at least 300 ft long northwest to southeast and 50 or more feet wide. It was in this area that the initial

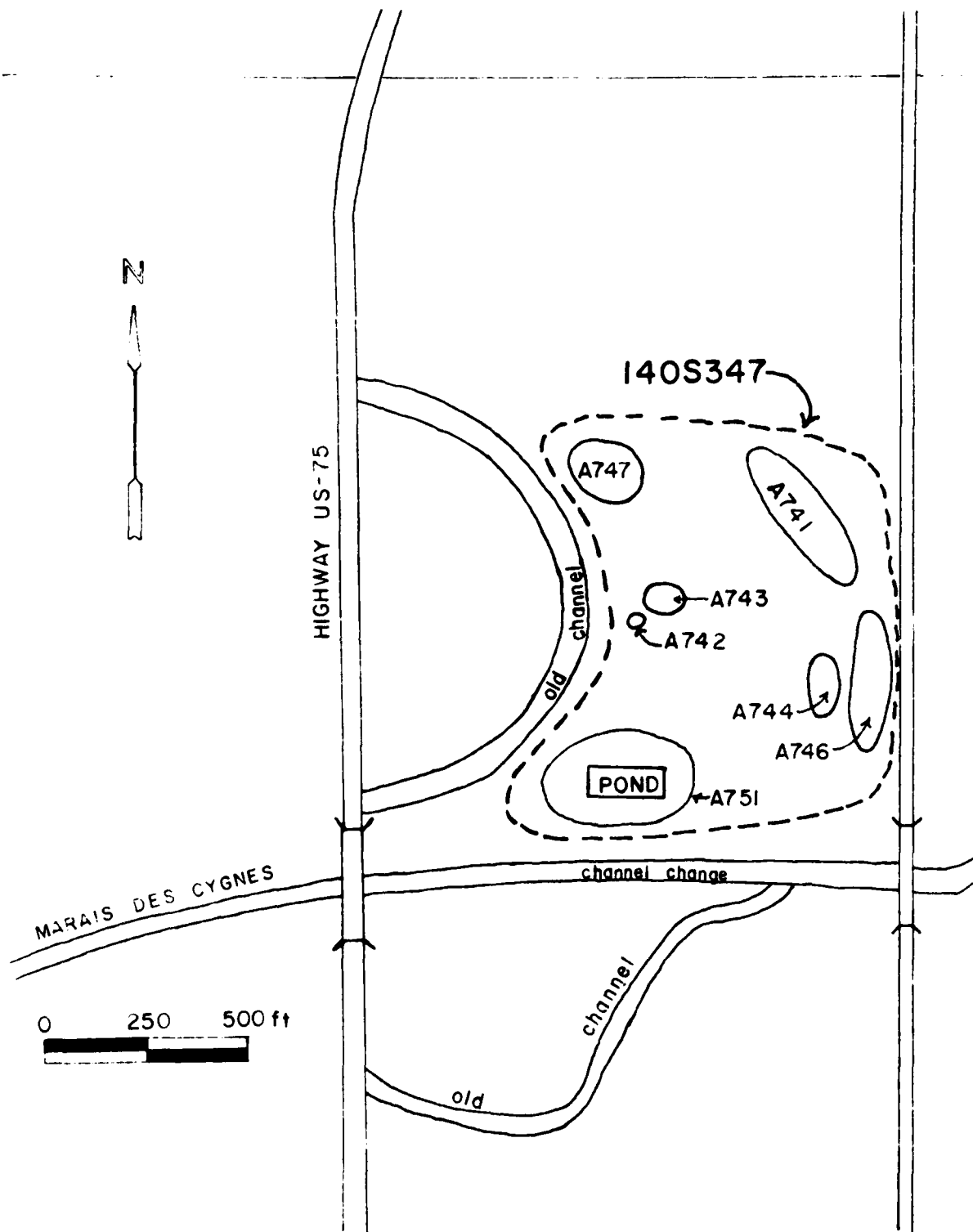


FIGURE 5: 140S347, Archeological site area designations

testing revealed the presence of a thick and deeply buried cultural level and it was this area that received the most attention during the August and September, 1974, investigations.

Area 742 was an area designated at the west side of the borrow pit where a limestone lined hearth was uncovered during highway construction activity (Figure 5).

Area 743 was an area at the west side of the borrow pit situated north and slightly east of Area 742 (Figure 5). Nine potential post-molds were identified in this area that may have formed elements of a prehistoric structure.

Area 744 was an area located approximately 300 ft to the south of the center of Area 741 (Figure 5). In this area, evidence of mixed soil containing charcoal and burned earth flecks, bone fragments and a few burned limestone rocks were found.

Area 746 was located south of Area 741 in the sides of the sloping cut for the borrow pit (Figure 5). Two hearths and remnants of a third were exposed in this area by construction equipment.

Area 747 was located at the northwest edge of the borrow pit in an area where little fill had been removed (Figure 5). In this area, a few human teeth were discovered in an area of disturbed soil.

Area 751 was located at the south end of the borrow pit and just west of the borrow pit limits (Figure 5). In this area, the U.S. Army Engineers eventually constructed two stabilization ponds.

Interarea Stratigraphy

It was difficult to maintain vertical control of materials that were uncovered in the borrow pit during construction. Thus, the following measurements of depth and thicknesses of levels within the borrow pit are, in some cases, approximations. Also, without knowing the precise land surface prior to fill removal, we had a difficult time establishing the actual depth of the deposits below the original ground surface. For our purposes, we will assume that the original ground surface in the borrow pit was a uniform 973 ft above mean sea level.

A thin zone of occupation was noted in several areas of the site at a depth of approximately 0.5 to 1.0 ft below the original ground surface (Figure 6). Four of the designated areas yielded evidence of a cultural level which occurred from approximately 3.25 to 5.5 ft below the original ground surface (Figure 6). Four areas yielded evidence of a more deeply buried cultural level which was located from approximately 9.5 to 12.5 ft below the original ground surface (Figure 6). Only two areas, Area 751 and Area 746, yielded evidence of all three of the cultural levels. In part, this is undoubtedly due to the fact that some of the cultural levels had been removed in the central part of the borrow pit prior to our investigations.

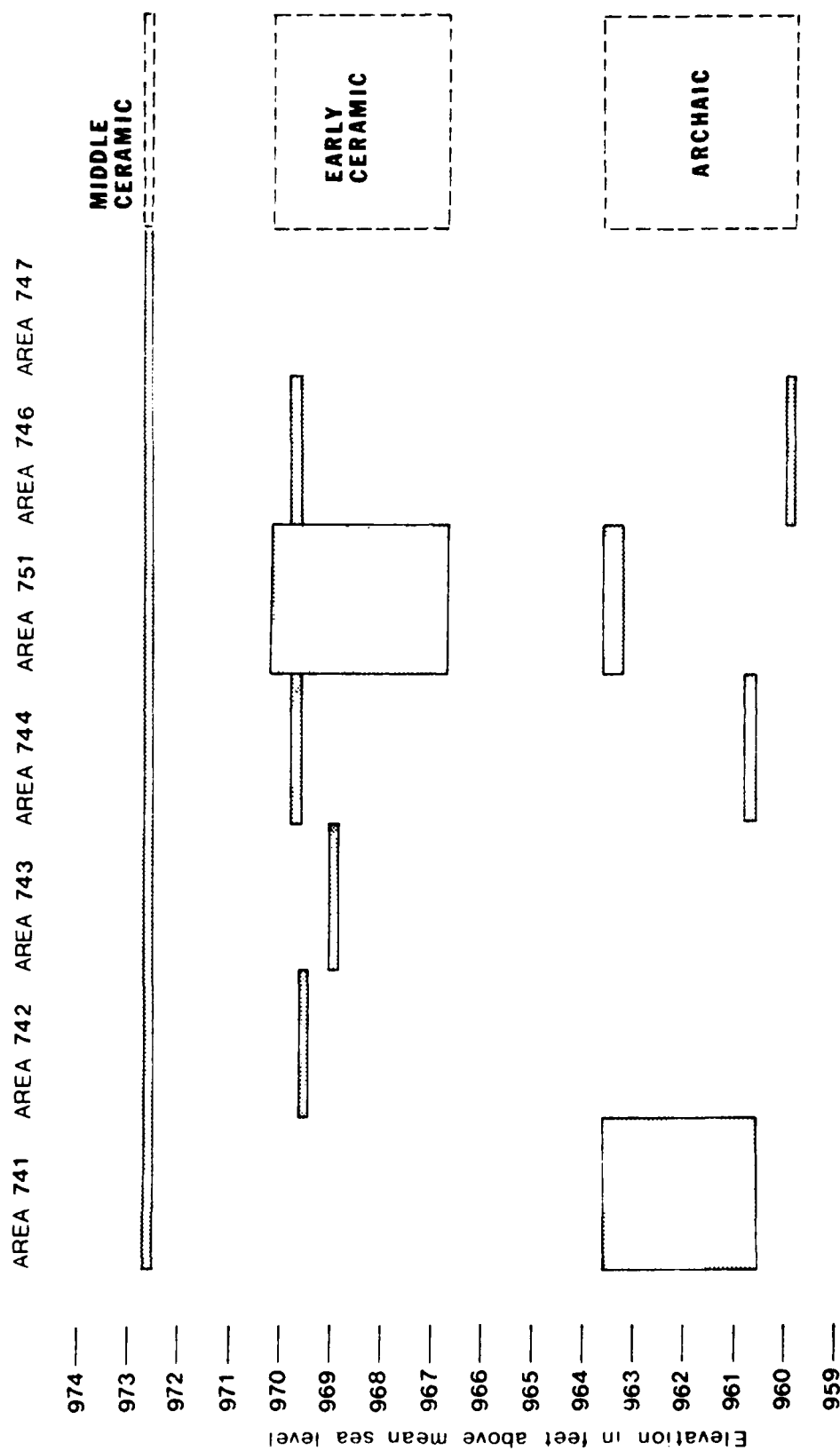


FIGURE 6: 140S347, vertical occurrence of cultural deposits within designated areas

SITE INVESTIGATIONS

Area 741

Area 741 was one of the areas which yielded evidence of the most deeply buried cultural level (Figure 5). In this area, clusters of burned rock, bone and mixed soil were encountered during the initial phase of testing the site. Each of these find spots was assigned a feature number, excavated, and then borrow removal was permitted to continue. Eventually, the borrow removal uncovered an area sufficiently rich in diagnostic materials to warrant more intensive effort and it was at this time that further borrow removal in this area was curtailed. It was also at this time that a formal grid was established to test the site in a more thorough manner. This test excavation was a 20 by 20 ft square excavation unit placed approximately in the center of Area 741, excavation unit A (Plate 5).

Stratigraphy

The approximately 3 ft thick cultural level which was found in Area 741 was composed of a brown clay which contained occasional flecks of burned earth and charcoal as well as structural features, artifacts, and animal bone and stone debris. Located above this level was a clay of darker color which was devoid of such cultural materials and immediately below it was a lighter colored clay which was similarly lacking in cultural evidence. The clearest vertical stratigraphic column found in Area 741 was identified on the northwest and northeast walls of excavation unit A. Excavation of Figure 7 reveals a cultural level of slightly more than 2 ft thickness on the northeast wall profile. Artifacts and structural features were found adjacent to excavation unit A at slightly higher and lower elevations and this accounts for the remaining foot of thickness of cultural deposits in Area 741.

Stratigraphy within the cultural level was difficult to interpret. A close examination of vertical profiles on the walls of excavation unit A revealed that there may have been three, or possibly four, separate cultural zones present within the general cultural level (Figure 7). In fact, these separate cultural zones (Figure 7: Zones B, C-1, C-2 and D) were not discernible during the excavation as they graded almost imperceptibly from one to the other, becoming slightly lighter in color from top to bottom, and all of them contained similar cultural materials. In contrast, the overlying and underlying culturally sterile zones (Figure 7: Zones A and E) were readily discernible during excavation. Based on vertical profiles, it

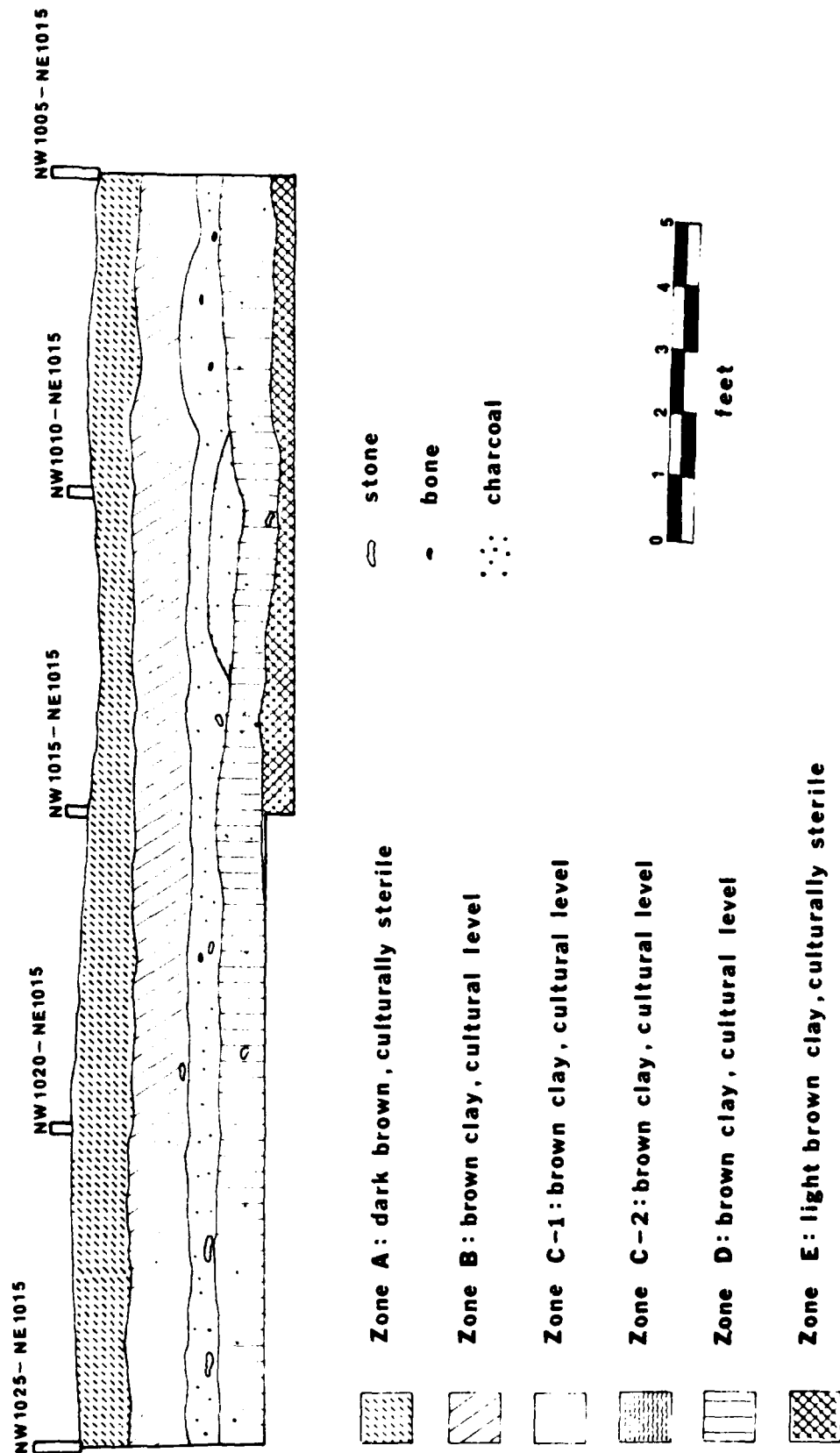


FIGURE 7: 14OS347, Area 741, vertical profile of the east wall of excavation unit A

can be noted that Zone B was a 1.0 ft thick soil zone which extended from 961.8 to 962.8 ft above mean sea level. Zones C-1 and C-2 were encompassed within a 0.5 ft thick soil zone which extended from 961.3 to 961.8 ft and Zone D, with a thickness of 0.8 ft, extended from 960.6 to 961.3 ft.

Exact vertical provenience was known for all featured materials (structural elements, artifacts, stone concentrations, and animal bone complexes) and this information was plotted (Tables 2 and 3) to determine if feature categories could be correlated with the suspected cultural zones. While this technique does not take into consideration those materials which were provenienced by excavation levels (e.g., 1.0 to 1.5 ft below datum), it does include those culturally diagnostic materials which were discovered in situ. Orifice depths of structural features encountered in excavation unit A are plotted in Table 2 and their horizontal placement is indicated on Figure 8. The orifice depths of hearths and basins are at or very close to original living surfaces as these features were well defined in horizontal section. Due to their somewhat amorphous nature, the two identified postmolds were not recognized until lighter colored soils were encountered near the base of the excavation. Thus, it is possible that they represent structural elements from a higher zone than is shown in Table 2. As Table 2 indicates, all four hearths and one basin occurred within the topmost cultural zone, Zone B, and a single basin was identified in association with the C-1/C-2 zone and another with Zone D.

Table 3 consists of the vertical distribution of featured artifacts, stone concentrations and animal bone complexes from excavation unit A. Artifact categories include projectile points, Munkers Creek knives, gouges, bifaces, mullers, worked limonite and chert cores. Stone concentrations include complexes of sandstone, limestone and chert flakes. Animal bone complexes are represented by occurrences of small clusters of animal bone, mostly broken, which were not correlated with hearths or basins, and which were therefore featured separately. The horizontal placement of these features is shown on Figure 8. Table 3 reveals that, while these materials were distributed at various depths throughout excavation unit A, the most culturally diagnostic materials (projectile points, Munkers Creek knives and gouges) were situated within Zone B. As indicated earlier, testing of the Archaic component in Area 741 was deliberately limited in scope. Thus, the sample size of diagnostic materials is quite small and the occurrence of these materials within only Zone B may be simply a sampling error.

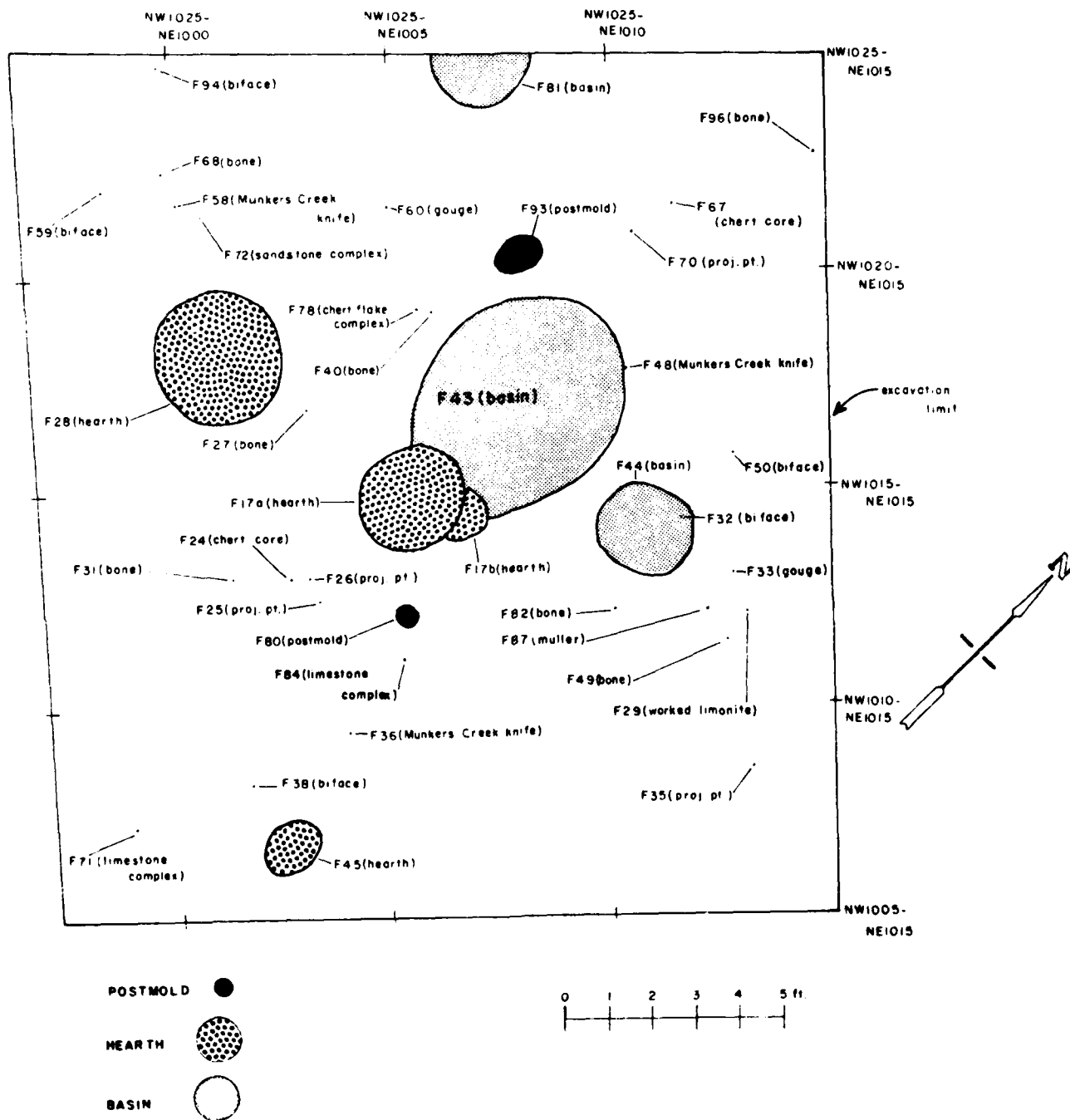


FIGURE 8: 140S347, Area 741, horizontal distribution of features within excavation unit A

TABLE 2: 140S347

Area 741, Vertical Distribution of
Structural Features in Excavation Unit A

<u>Elevation in Feet above M.S.L.</u>	<u>Postmold Orifice</u>	<u>Hearth Orifice</u>	<u>Basin Orifice</u>
962.8			
962.7			
962.6			
962.5			
962.4		F17a	
962.3			
962.2		F17b & F28	
962.1			
962.0		F45	F43
961.9			
961.8			
961.7			
961.6			F44
961.5			
961.4			
961.3			
961.2			
961.1	F93		F81
961.0			
960.9			
960.8	F80		

TABLE 3: 140S347

Area 741, Vertical Distribution of Featured Artifacts, Stone Concentrations
and Animal Bone Complexes in Excavation Unit A

Elevation in ft above M.S.L.	Projectile Points	Munkers Creek Knives	Couges	Bifaces	Mullers	Worked Limonite	Chert Cores	Stone Concentrations	Animal Bone Complexes
962.8	F35								
962.7									
962.6		F58							
962.5			F60	F38 & F59					
962.4								F72	F68
962.3	F26								
962.2				F32				F71	
962.1	F25						F24	F78	F27 & F31
962.0		F36					F67		- 67 -
961.9	F70	F48				F29			
961.8			F33						F40
961.7									
961.6									
961.5				F50					F49
961.4				F94					
961.3									
961.2								F84	F96
961.1									
961.0									F82
960.9					F87				

The finding of artifacts, structural elements, and concentrations of animal bone and stone throughout the 3 ft thick cultural level in Area 741 suggests that the entire level represents an occupation and reoccupation, possibly on a seasonal basis, by the same or related groups of people.

Structural Evidence

Postmolds:

Two features were encountered in Area 741 which are interpreted to be postmolds (Figure 8). Both of these were found in excavation unit A. The first of these (F80) was situated about 2.5 ft southeast of the center of one of the hearths. This postmold had an orifice diameter of 0.5 ft and it extended down 1.0 ft below the orifice. The fill of the postmold was a dark humic soil which contained flecks of charcoal and burned earth. The postmold could be the remnant of a crane or suspension post connected with the nearby hearth, or it could be part of some undiscovered structure. The second postmold (F93) was located 6.0 ft north of the same hearth. This postmold was marked by a small concentration of burned limestone and a dark oval soil discoloration in horizontal profile. When cross-sectioned and cored, the postmold proved to have an orifice diameter of 1.0 ft by 0.7 ft and it extended to a depth of 1.4 ft below the surface upon which it was first identified. The function of this postmold could not be determined, but it is interesting that both of these postmolds were identified in horizontal section at approximately the same elevation. Thus, they could be related postmolds from some undiscovered structure.

Hearths:

A total of seven hearths were identified in Area 741. Four of these were identified in excavation unit A (Figure 8) and the three remaining hearths came from other locations within Area 741. These hearths were typically oval to circular in shape and were lined with limestone cobbles which had been placed in shallow, intentionally dug basins. The hearths contained charcoal, burned earth, burned animal bone and, in all cases, the limestone had been burned red or gray. Carbon samples for eventual radiocarbon dating were obtained from several of the hearths and archeomagnetic samples of burned earth were recovered from two of the hearths (F17a and F28) in excavation unit A. The largest of the hearths was oval in shape and measured 3.0 ft by 4.0 ft in diameter. The smallest of the hearths (F45) was just slightly in excess of one foot in diameter. In one case, a hearth (F17b) was superimposed immediately on top of a previously built hearth (F17a).

Basins:

Four basin-shaped and trash-filled shallow pits were identified in Area 741. Three of these were found in excavation unit A (Figure 8) and the fourth was found outside excavation unit A during borrow activity. The largest of these was a shallow trash-filled basin (F43) which was located underneath the two fire hearths which were superimposed stratigraphically on top of one another. This basin measured 4.0 ft north to south and 3.25 ft east to west and it had a depth of 0.6 ft from the orifice to the bottom of the basin in the center. The basin was filled with soil of darker color than the surrounding soil and it contained charcoal, burned earth, burned bone and burned stone fragments. Two of the other basin-shaped pits (F44 and F81) had orifice diameters of 2.0 ft and depth of 0.4 ft and 1.5 ft. Both contained burned earth, charcoal, dark humic soil and scattered stone. The remaining basin consisted of the truncated remains of a small trash-filled pit, located to the south and west of excavation unit A in Area 741.

Stone concentrations:

Four concentrations of stone were identified in excavation unit A (Figure 8). Two of these (F71 and F84) consisted of small clusters of burned limestone rocks. One other (F72) consisted of two unmodified sandstone rocks. The remaining concentration (F78) consisted of a cluster of chert cores and chert flakes. The flakes and cores may mark a workshop area within the general site and could indicate a specialized activity area at the site.

Artifacts

Projectile points:

A total of six projectile points or projectile point sections were recovered from Area 741. Five of these were recovered from excavation unit A and the sixth projectile point was recovered from an area just to the west of excavation unit A. The recovered projectile points are of quite variable types. One of the complete points is a contracting stemmed dart point with a length of 59 mm and a width at the shoulder of 32 mm (Plate 10, A). The stem accounts for approximately one third of the length of the projectile point. This point is biconvex in transverse section. The blade is triangular in outline with slightly excurvate edges. This specimen measures 9 mm in thickness. This point is made from a banded chert which has white, pink and gray coloration.

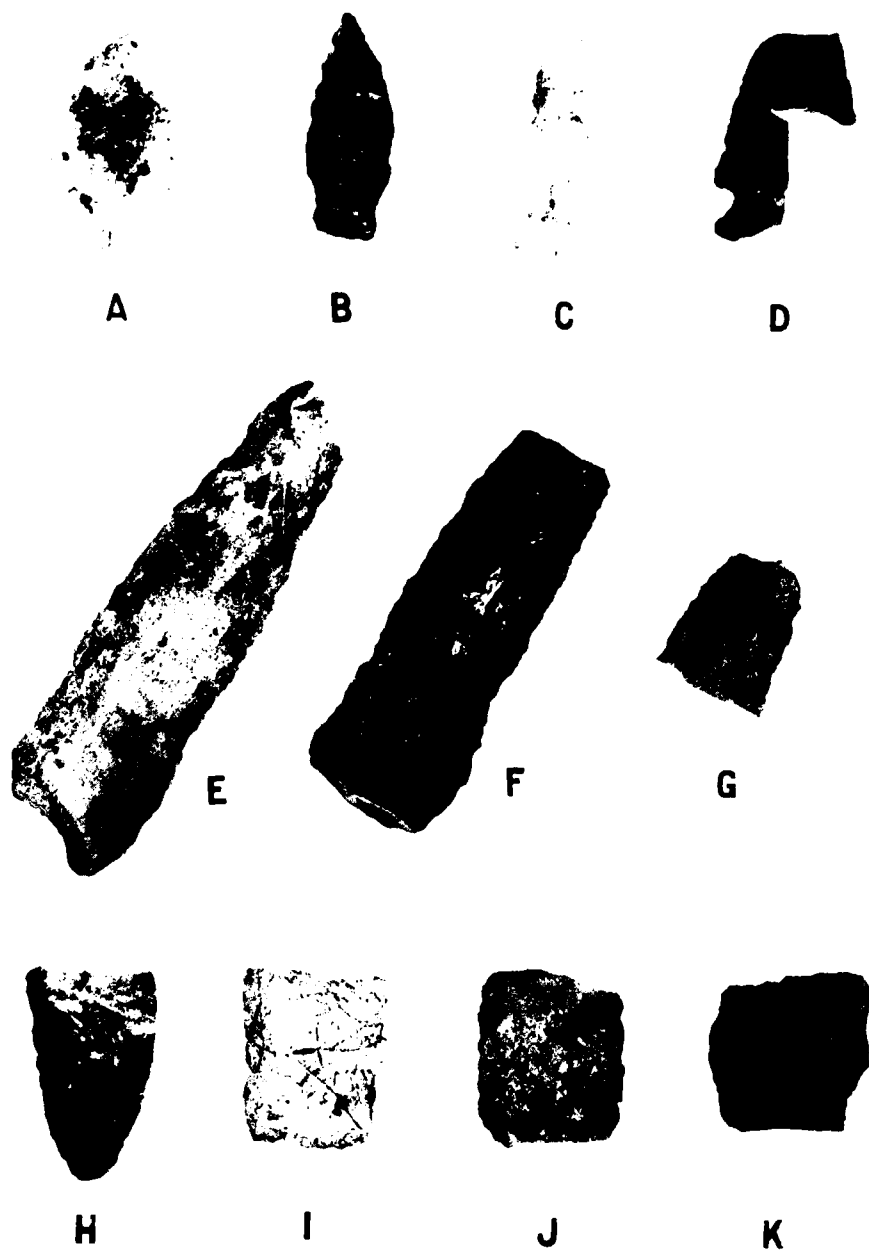


PLATE 10: 140S347, Area 741, projectile points, knives and gouges from the Archaic level

The second specimen (F35) is a straight to slightly contracting stemmed dart point that is slightly lanceolate in outline (Plate 10, B). This specimen is made from a gray to reddish gray chert and it measures 54 mm long by 21 mm wide by 10 mm thick. The stem is slightly less than one third of the total length of the artifact. As mentioned above, the blade is slightly lanceolate in form with excurvate edges. The broadest point on the projectile point is midway between the tip and base area. The base is straight to slightly convex.

The third projectile point (F26) recovered from Area 741 is a portion of a side notched point that measures 57 mm long by 23 mm wide by 8 mm thick (Plate 10, C). This specimen is made from a white and fine grained chert that has a pinkish tinge to it in some areas. This point is slightly diamond-shaped in cross-section and apparently was somewhat asymmetrical. The blade is slightly leaf-shaped and the edges are excurvate. The blade below the side notches is 12 mm long.

The fourth projectile point recovered from Area 741 is a portion of a corner notched projectile point with an estimated original length of 69 mm, width of 32 mm and thickness of 9 mm (Plate 10, D). The blade is triangular in outline with straight edges. The specimen has moderately developed barbs and an expanding stem with a concave base. The stem is 13 mm long, the specimen is biconvex in cross-section and is a weak red in color.

One of the remaining projectile point sections (F70) is a portion of the stem of a medium sized projectile point and the other (F25) is a portion of a midsection of a medium sized projectile point.

Bifaces (Munkers Creek blades):

Two bifacial knives were recovered from excavation unit A, in Area 741 which are of the Munkers Creek blade type. The Munkers Creek complex is an Archaic complex proposed by Witty for the lower component of the William Young site excavated in Council Grove reservoir of east central Kansas (Witty 1969). Typically these bifaces are elongated, curved chert bifaces with unfinished bases and a pronounced polish or gloss across both blade faces. The two nearly complete specimens recovered from excavation unit A fall within this category. The first (F58) is a large biface measuring 128 mm long by 36 mm wide at the base and with a maximum thickness of 15 mm (Plate 10, E). This specimen is made from a white to very pale brown chert. It has a limy substance adhering to the faces which appears to be the actual cortex of weathered chert that was present

before the artifact was produced. The second specimen (F48) is missing the tip (Plate 10, F). This specimen is made from a gray chert and it measures 92 mm long by 36 mm wide at the base and has a maximum thickness of 15 mm at the butt. The silica polish on both faces is very distinct in this case. A tip section of another possible Munkers Creek biface blade (F36) was also recovered from Area 741 in excavation unit A (Plate 10, G). The specimen is made from a very pale brown chert and it has the typical polish on the two faces.

Bifaces (Gouges):

Four chipped chert gouges were recovered from excavation unit A in Area 741 (Plate 10, H-K). These gouges were made from broken and reworked Munkers Creek blades. The Archaic component from the William Young site also contained broken and reworked gouges very similar in type to these. Three of these gouges are made from the base sections of Munkers Creek blades. The fourth is made from a tip section of a Munkers Creek blade. The gouges range in length from 29 mm to 50 mm long and in width from 31 mm to 38 mm. They range in thickness from 11 to 13 mm. Typically, one of the ends of each gouge has been flaked to form a beveled edge for possible scraping or gouging purposes. Three of these specimens are made from light gray chert and the fourth is made from a reddish yellow to light red chert. All exhibit at least some silica polish from the previous use as knives.

Bifaces (Other):

In addition to the aforementioned bifaces found in Area 741, eight irregularly shaped bifaces were found (Plate 11, A-D). These range in shape from subrectangular to ovate to irregular-shaped objects and they tend to be fairly thin bifaces. Most are made with percussion techniques of flaking and the stone that was used to make them is characteristically a light brownish gray or light yellowish brown or very pale brown chert. One of the specimens is made from a fine grained gray chert. The largest of these bifaces is a subrectangular thin biface with a length of 72 mm, a width of 34 mm and thickness of 16 mm. The smallest is a fairly thick biface with a length of 40 mm, a width of 28 mm, a thickness of 15 mm and an ovate shape. These are probably small cutting implements or preforms.

Scrapers:

One small uniface scraper section was recovered from Area 741. This specimen is made from a fine grained chert. The specimen consists of a 30 mm long edge section of a uniface

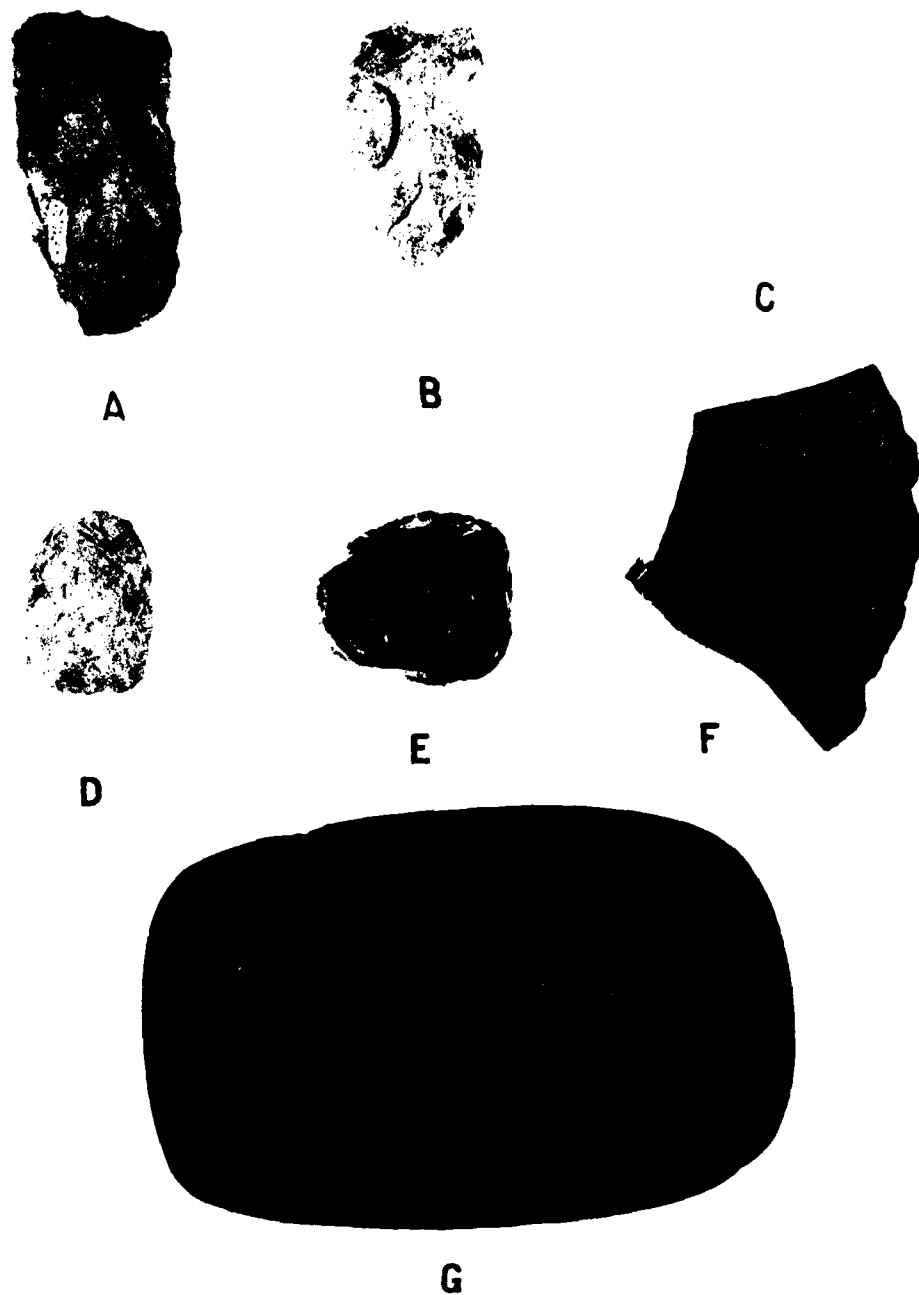


PLATE 11: 140S347, Area 741, chipped and ground
stone implements from the Archaic level

scraping tool that is 10 mm thick. The tool was produced solely with percussion flaking methods.

Utilized flakes:

Four additional chert tool sections were recovered from the site. These are chert flakes that have discontinuous pressure flaking along one or more edges. This pressure flaking could be the result of use as scraping or cutting tools. One additional chert flake has had flakes struck from two edges and appears to be similar to a burin.

Chert flakes:

A total of 440 flakes from the waste material left as a residue of the manufacture of stone tools were recovered in Area 741 at site 140S347. Sixty-one of these flakes have cortex over most of at least one face and can be considered primary decortication flakes. These are the first flakes struck from a cobble during the preparation of a chert core. At this site, most of these flakes were apparently discarded. The cortex present on the faces indicates that these flakes were predominantly struck from river cobbles of chert. One hundred and sixty-three of the recovered flakes are secondary decortication flakes. These have some of the cortex still adhering to at least one face. Again the primary chert source seems to have been river cobbles. Two hundred and sixteen flakes show no evidence of cortex. Many of these are quite irregular in shape and they range from tiny flakes smaller than a fingernail to flakes in excess of 70 mm in length. A few of these are what could be considered shatter.

Cores (Prepared or partially prepared):

A total of 24 prepared or partially prepared chert cores were recovered from Area 741. None of these show a high degree of preparation, although several of the cores do have more than one striking platform. Predominantly, these seem to have been made from chert river cobbles of fairly small size as cortex indicating a river origin is found on a number of the specimens.

Cores (Rudimentary):

A total of 31 rudimentary cores were recovered from Area 741. All of these are river cobbles that have had one or more flakes detached from them. Basically, these are river cobbles which have had small sections of the cortex removed by percussion flaking. These are probably either cores in an early stage of production or cobbles which were being tested

for their quality. These range in color of the external matrix from a light to dark brown and they range in size from small pebbles to large sized cobbles. Exposed areas of the chert reveal it to be an almost universally gray to light gray in color.

Ground Stone Muller:

One complete muller or hand grinding stone (F87) of very hard, fine grained sandstone of red color was found in Area 741 (Plate 11, G). This specimen is very well prepared. It has been pecked all around the edges and then ground convexly on both faces. In color it is a dark red and it measures 135 mm long by 88 mm wide by 48 mm thick. This artifact was the deepest buried artifact recovered from excavation unit A in Area 741.

Pecked Hammerstone:

One very small hammerstone made from a small river cobble of chert was recovered from Area 741 (Plate 11, E). This specimen is approximately 45 mm in diameter and is very roughly spherical in shape. Some of the cortex has been battered off along one edge of the specimen and crushing is evident on the chert interior. It is likely that this specimen was used as a hammerstone in the preparation of chipped stone tools or other objects.

Worked Hematite and Limonite:

Five pieces of iron ore were recovered from the site which show evidence of grinding and incising (Plate 11, F). These are all made from a fairly soft stone that appears to be limonite with some hematite in it. The largest specimen (F29) is 84 mm long by 60 mm wide by 15 mm thick. The softness of these specimens would suggest that they were used as raw material for the manufacture of pigment.

Miscellaneous Stone:

In addition to the stone tools discussed previously, fairly large quantities of limestone and some sandstone were recovered from Area 741. These usually occurred as single fragments of cobbles or occasionally as clusters of limestone or sandstone. One quartz pebble and some as yet unidentified stone pebbles were also recovered in the site area as well as several fragments of hematite and limonite which show no evidence of having been worked.

Chert River Cobbles:

Forty-two unmodified cobbles and pebbles of river derived chert were recovered from Area 741. These typically have a very well smoothed and polished surface from being repeatedly tumbled. These range in size from tiny pebbles to cobbles nearly as large as a clenched fist. The cortex is typically light or dark brown in color. The presence of these cobbles in the deep cultural level in Area 741 could be explained naturally, since the Marais des Cygnes river is nearby. It is more likely, however, that these stones were intentionally carried to the site by the prehistoric inhabitants. Both the rudimentary and the prepared chert ores recovered from the site are typically made from identical river cobbles and the primary and secondary decortication flakes found at the site also indicate the same origin for the raw material.

Faunal Remains:

Over 1,000 fragments or sections of animal bone were recovered from Area 741. It is somewhat unusual for an Archaic component to yield this much faunal information in eastern Kansas, so the following data should provide some needed information to aid in the interpreting of Archaic subsistence patterns. Ninety-one bone elements were identifiable to genus and species and these were all mammals (Table 4). In addition, 17 sections of turtle carapace were recognized and 5 fish vertebra were tentatively identified. Of the identifiable mammal bone, white tailed deer comprised 50 percent of the sample. The only other significant percentages were: bison, 22 percent and beaver, 16 percent. These percentages are based simply on bone units and do not reflect available meat or calories. Notably absent from the sample are shellfish.

Flora:

Charcoal specimens and a few charred seeds recovered from excavation unit A in Area 741 will eventually provide some information about the local environment at the site and may also provide additional data about subsistence practices as well as being useful for radiocarbon determinations.

Burned Earth:

Small samples of orange and black colored burned earth were recovered throughout the cultural zones in excavation unit A. These are common to any area where open fires have burned for appreciable lengths of time.

TABLE 4: 140S347,
Area 741, Faunal Remains

Cervidae

<i>Odocoileus</i> (prob. <i>virginianus</i>) white tailed deer	<u>Element</u>	<u>Number</u>
	Scapula (indet.)	1
	Right	2
	Left	1
	Occipital Condyle	1
	Vertebra	3
	Rib	2
	Right Ulna	1
	Left Ulna	1
	Metapodial (indet.)	9
	Metatarsal	2
	Carpal	3
	Tarsal	7
	Right Astragalus	3
	Left Astragalus	1
	Left Calcaneus	4
	Phalanx	<u>5</u>
	Total	46
	1 bone subadult	

Bovidae

Bison bison

Left Mandible section	1
Vertebra	3
Innominate	2
Left Ulna	1
Rib	2
Right Tibia	2
Metapodial (2 subadult)	5
Phalanx	3

TABLE 4 (Continued)

Bovidae

Bison bison

<u>Element</u>	<u>Number</u>
Left Astragalus	<u>1</u>
Total	20

Leporidae

Sylvilagus floridanus
Cottontail rabbit

Right Scapula	1
Left Scapula	<u>1</u>
Total	2

Procyonidae

Procyon lotor
Raccoon

Left Ulna	1
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Castoridae

Castor canadensis
Beaver

Left Maxilla	1
Right Mandible section	1
Incisor	2
Fourth Premolar	1
Molar fragments	3
First Molar	1
Second Molar	1
Third Molar	2
Left Scapula	1
Left Ulna	1
Left Astragalus	<u>1</u>
Total	15

Canidae

Canis latrans
Coyote

Cranial fragment	1
Left Humerus	1
Right Ulna	1

TABLE 4 (Continued)

Canidae

Canis latrans
Coyote

<u>Element</u>	<u>Number</u>
Right Femur	1 (subadult)
Metapodial	<u>1</u>
Total	5

Canis (species uncertain,
probably small *latrans*)
Coyote

Right Front Foot bones
2nd through 4th Metacarpal plus 4 carpals
Left Rear Foot bones
2 Metatarsals plus 1 Tarsal

Turtle (17 carapace sections)

Fish (5 possible fish vertebrae)

Summary

The investigations and excavations performed in Area 741 demonstrated the presence of a very deeply buried and surprisingly rich cultural component at the Cow-Killer site. Artifacts collected from this level represent an Archaic component which probably dates from around 3,000 B.C. Evidence recovered included both structural features, such as hearths and basins, as well as stone artifacts, animal bone, charred vegetal remains and additional debris. The tentative identification of possibly three distinct cultural zones within the Archaic level suggests either a long occupation or subsequent reoccupations of the site area by an Archaic people or peoples. This Archaic level is of importance because of its antiquity, the richness of the deposit and because of the extreme scarcity of sites in Kansas attributable to this period. It was the consensus of the concerned agencies (Society, Department of Transportation and Corps of Engineers) that preservation of this level be accomplished by curtailing borrow removal in this area and by covering the extant portions of the level with top soil. This was accomplished and the area has since been returned to native vegetation.

Area 742

Area 742, located at the west side of the borrow area, yielded a cluster of burned limestone rocks with associated charcoal fragments and small amounts of burned earth (Figure 5). This complex was initially identified during the scraping of the area with power equipment for borrow removal. The upper portion of the complex had evidently been removed by the power equipment prior to the identification of the feature. The burned rock and associated debris formed a circle with a diameter of 5.5 ft. The feature extended to a depth of 0.75 ft below the truncated orifice and this suggested that the limestone rock had been placed in a shallowly excavated basin prior to burning. We interpreted this cluster of materials to be the remnant of a stone lined hearth which had been utilized for only a short period of time. The hearth intruded into a dark humic soil and its vertical placement within the site suggested that this hearth was associated with the Early Ceramic or Plains Woodland component at the site.

Area 743

Area 743, also located at the west side of the borrow area, was initially identified while the construction equipment was still active in the area (Figure 5). In this area, evidence of nine soil discolorations which showed as dark circles in horizontal section was uncovered by power equipment. When cored, these features extended below the surface and had the appearance of being post or posthole molds which had filled with dark topsoil after the posts had either rotted, burned or been removed. These possible posthole molds were situated approximately 6.0 ft apart. Six of them formed an east-west line, 34 ft long and the other three were set off at a 90 degree angle from the east end and extending 18 ft to the north. The suspected posthole molds ranged in diameter from 0.55 ft to 1.5 ft and in depth from surface from 1.1 to 2.25 ft. The very even placement of these possible postmolds would certainly suggest that they were elements of some sort of structure. Unfortunately, the area was devoid of artifacts or other refuse suggesting human occupation. It seems likely that any cultural materials present were removed by the construction equipment and that the remaining posthole molds were thus the truncated remains of posthole molds which originally extended higher into an overlying culturally mixed soil. Because the overlying levels had been removed by construction equipment, there was no way that we could, with certainty, identify the cultural level with which this suspected structure was associated. The general level at which the posthole molds were identified would suggest an affiliation with the Plains Woodland or perhaps an even more recent occupation.

Area 744

Area 744 was located to the south of Area 741 (Figure 5). In this area, construction equipment uncovered a small cluster of burned limestone rock and a thin layer of culturally mixed soil which contained charcoal and burned earth flecks, bone fragments and miscellaneous rocks. This culturally mixed soil zone was underlain by a light tan silty soil which contained caliche and which did not have any cultural materials in it. The thin cultural zone identified in this area was located at approximately the same depth as the cultural level in Area 741 and was apparently a remnant of the same occupation.

Area 746

Area 746 was located to the south of Area 741 in the sides of the sloping cut for Borrow Area Number 4 (Figure 5). Two stone lined hearths were here exposed about 3.0 ft beneath the original ground surface. Since the hearths were not further endangered by borrow removal, they were simply partially exposed and verified and then covered. The stratigraphic position of these hearths within the site area suggests a Plains Woodland cultural affiliation. In any case, the area where these hearths were located has been stabilized and returned to native vegetation. A remnant of a possible third hearth was located much further down on the sloping cut of the borrow pit. Too little of this hearth remained for it to be diagnostic and the cultural zone which it had been associated with had evidently been removed by construction activity. Nevertheless, this area provided at least some evidence of the same deeply buried cultural zone which was identified in Area 741 and 744.

Area 747

Area 747 was located at the northwest edge of Borrow Area Number 4 in a portion of the borrow area where very little fill was removed (Figure 5). In this area, a number of human teeth and a portion of a human mandible and a potsherd were found. Unfortunately, the soil in which these items were found had been much disturbed, and some of it consisted of dirt which had originated in other portions of the borrow pit. Thus, the materials found in this area could have originated in other areas. Since further borrow removal from this area was not done, no attempt was made to test further in this area. The finds in this area, even if displaced, have significance, as they suggest another major human activity, burial of the dead.

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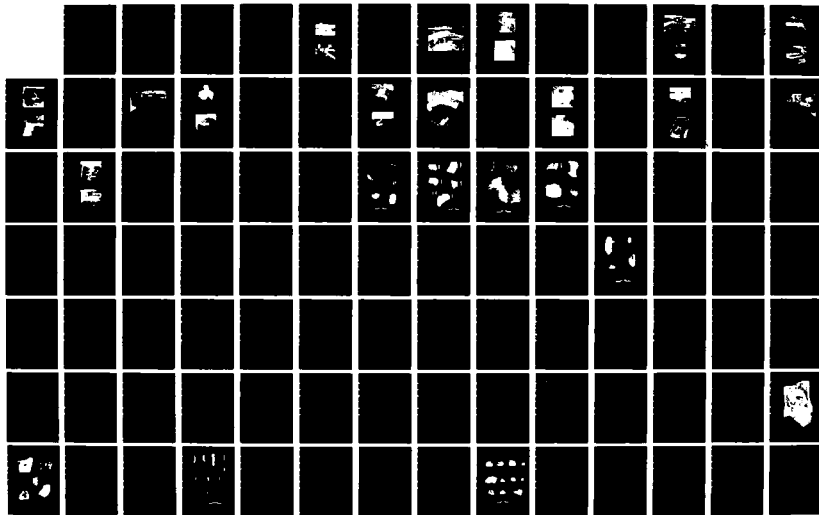
ARCHEOLOGICAL INVESTIGATIONS AT THE COW-KILLER SITE
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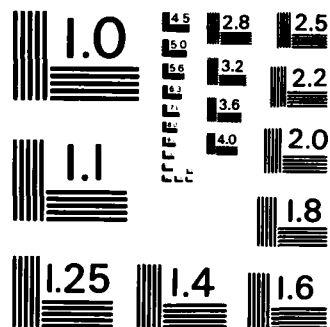
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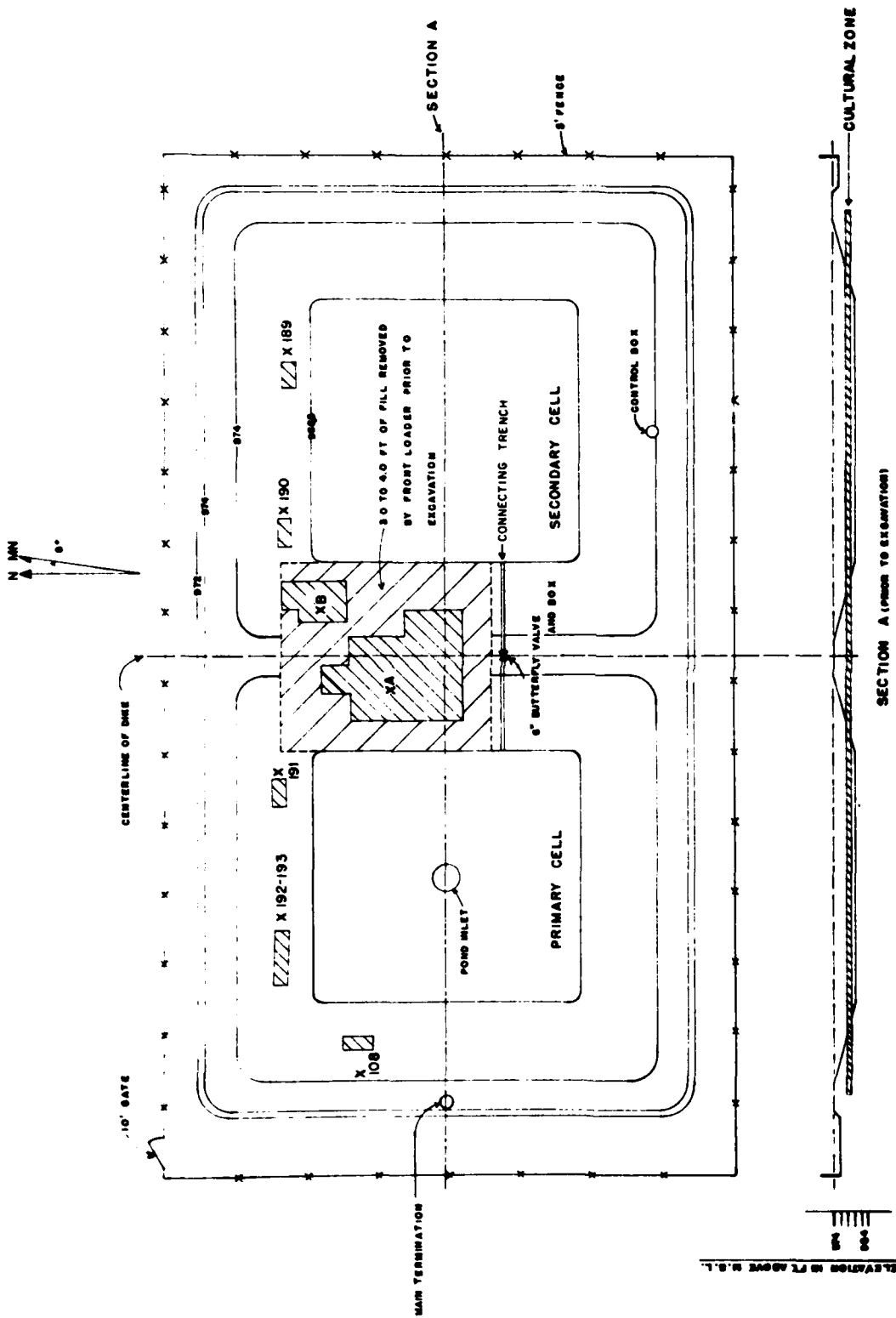
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

In addition to the seven assigned areas mentioned above where complexes of cultural materials were found, isolated finds of artifacts were made throughout the 140S347 site area. In particular, wherever the original top foot of soil was present, thinly scattered evidence of a Middle Ceramic period occupation of the site was noted. This typically included the occasional finding of small triangular-shaped projectile points and clay tempered potsherds.

Area 751

The focus of the 1975 work at 140S347 was in the area of the central dike which separated the two stabilization ponds (Figures 9 and 10). This 70 by 150 ft area of relatively undisturbed fill had earlier been tested by Society archeologists and had yielded evidence of a fairly thick habitation zone and also grass impressed daub fragments from two areas which suggested the presence of one or more burned habitation structures. Due to the thickness of the overlying sterile zone in the central dike area, we first stripped off the sterile overburden to a depth of approximately 3 ft below the top of the constructed dike. The stripping was accomplished by using machinery and personnel from the U.S. Army Corps of Engineers, Melvern lake project (Plate 12). The cut was made in two phases.

First, slightly more than one foot of soil was removed from the top of the dike. This yielded an approximately original ground surface prior to the stabilization pond construction. At this time, further power removal of earth was halted because of the presence of scattered cultural materials in the newly scraped surface. Evidence of more recent aboriginal materials was expected within this zone as they had previously been observed at this approximate depth in other areas of the site. Accordingly, two 5 ft wide by 25 ft long excavation units (excavation units 186 and 187) were placed at right angles to the long (north-south) axis of the dike to test this hypothesis. These units were then excavated with shovels by one-half ft thick arbitrary levels and the materials found within each 6 inch level were kept separate (Plate 13). These tests indicated that there was some evidence of a very thin cultural zone contained within what had originally been the top foot of soil at the site. A few burned limestone rocks and an occasional chert flake were found during this testing. Further work in this very sparse zone would have been unproductive so, at this time, Corps personnel returned and continued stripping soil from the site. This was accomplished with full monitoring of the earth moving by Society archeologists. After the top 3 ft of soil had been removed from the central dike, an arbitrary grid of 10 ft by 10 ft squares was established across the surface of the dike area from the connecting trench north to the east-west berm (Figure 10). Excavation of the 10 ft squares was accomplished using



ARCHAEOLOGICAL SITE 14OS347

THE COW-KILLER SITE

AREA 751, EXCAVATION UNITS (X-UNITS)
IN MELVERN RESERVOIR STABILIZATION PONDS
KANSAS STATE HISTORICAL SOCIETY, 7-9-78



FIGURE 9: 14OS347, Area 751, map of excavation units located in the stabilization pond area

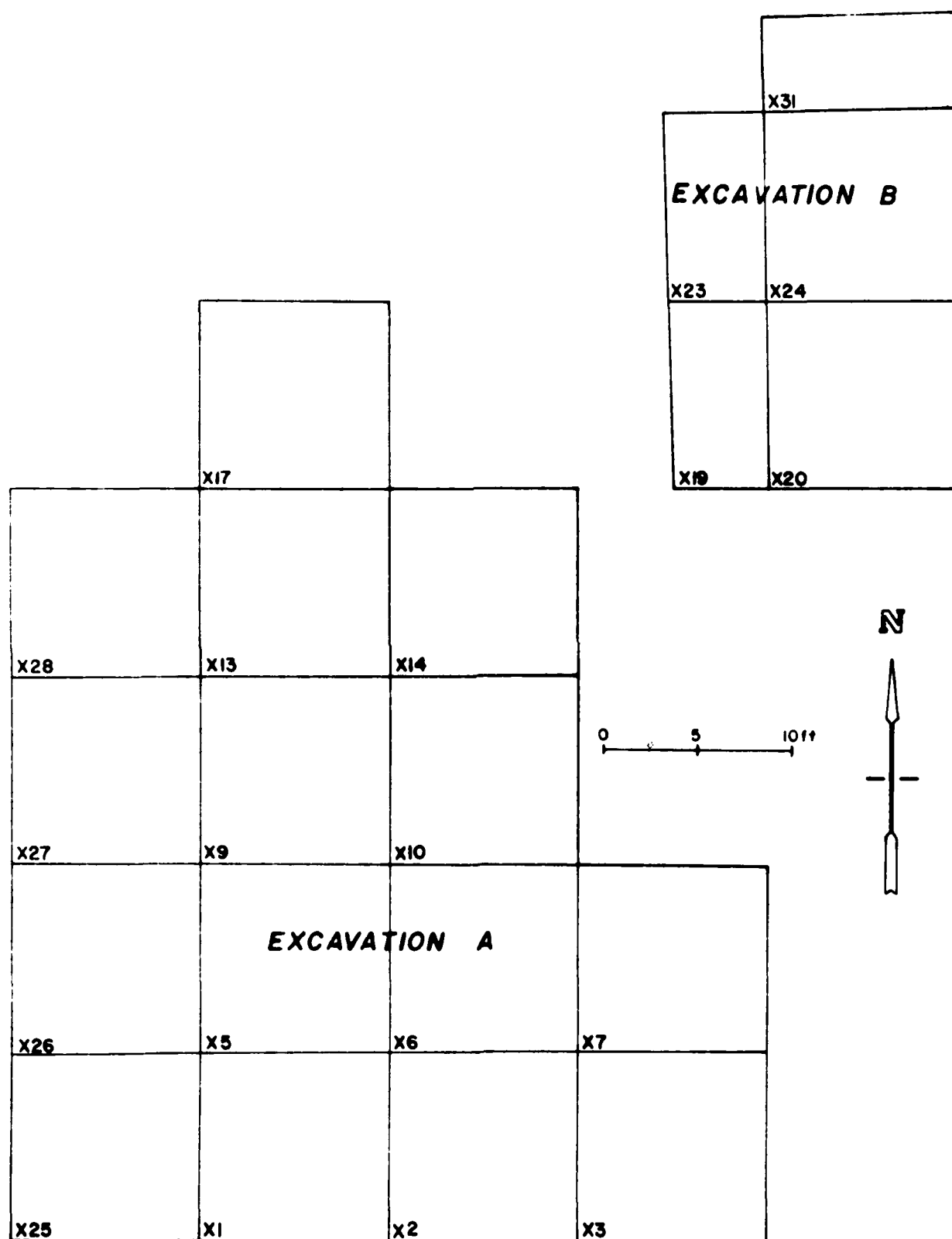


FIGURE 10: 140S347, Area 751, map of X units in Excavation A and B on the central dike between the stabilization ponds



PLATE 12: 14OS347, Area 751, removing overburden from the central dike area



PLATE 13: 14OS347, Area 751, test trenches (X186 & 187) in the central dike area

shovels and hand trowels to remove one-half foot or less of soil from selected squares (Plate 14). Excavation continued in each 10 ft by 10 ft square until the culturally sterile underlying soil was encountered. Materials recovered from the one-half foot (or occasionally one-quarter foot thick) zones in each square were separately bagged by square and level. Particularly diagnostic or significant artifacts (e.g., potsherds, chipped stone tools, etc.) were further isolated by assigning feature numbers to them and individually measuring and mapping each one. In addition, horizontal profile drawings of excavation units were made when sufficient nondiagnostic material was encountered (e.g., random scattering of burned limestone, bone fragments, etc.). Initially, balk walls of one-half foot thickness were maintained between squares. These were eventually removed to facilitate the interpretation of possible structural features. Control blocks with 2 by 2 by 18 inch wooden stakes marked the corner of each excavation unit. These points were left in place until the end of the dig and they allowed maintenance of tight horizontal and vertical control on find spots within each square.

In the following sections of this report, the numbered excavation units in Area 751 will be referred to as X units (e.g., X unit 1, 2, 3, etc.) or simply as X1, X2, etc. Figures 9 and 10, pages 83 and 84 of this report, show the horizontal locations of each of these X units. For comparative purposes, X units 1, 2, 3, 5, 6, 7, 9, 10, 13, 14, 17, 25, 26, 27 and 28, which comprise a large block of contiguous 10 ft by 10 ft squares on the central dike, will be referred to as Excavation A. Similarly, another block of squares, X units 19, 20, 23, 24 and 31, will be referred to as Excavation B. Excavation B is also located on the central dike, but it is situated slightly northeast of Excavation A.

In addition to the primary excavations within the area of the central dike, six 5 by 10 ft squares were placed along the north sloping berm of the east sedimentation pond and the north and west sloping berms in the west sedimentation pond (Plates 15 and 16, and Figure 9). These tests were conducted during the initial week of the 1975 investigations and were necessitated by very wet conditions which prevented stripping of the central dike for several days. These tests revealed the presence of a buried habitation zone in excess of 2 ft in thickness on the sloping berm which contained charcoal, burned earth, chert tools and debitage, shell, burned and unburned limestone, sandstone, potsherds, animal bone, etc. These occurred either as isolated finds within the general cultural level revealed in the berm, or as complexes of trash which appeared to be middens or trash-filled basins. No evidence of habitation structures was encountered in these adjacent areas.



PLATE 14: 140S347, Area 751, gridded squares in
Excavation A on the central dike, view to south



PLATE 15: 140S347, Area 751, tests (X189 & 190) on the north slope of the secondary (east) cell, view to east

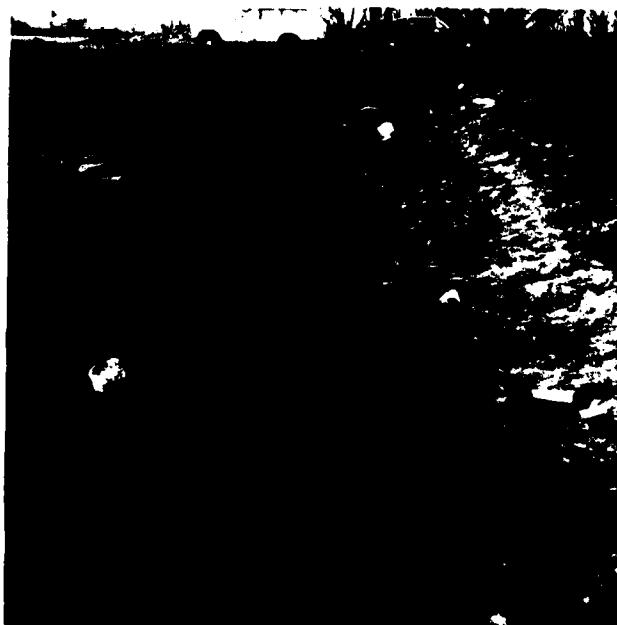


PLATE 16: 140S347, Area 751, tests (X191, 192 & 193) on the north slope of the primary (west) cell, view to west

Structural Evidence

Excavation of Area 751 revealed the presence of a 2.5 ft to 3.5 ft thick zone of soil which contained cultural materials consisting of structural features, such as postmolds, hearths, trash-filled basins, intentionally prepared pits and complexes of trash, as well as artifacts and ecofacts. As will be discussed in more detail in the section of this report dealing with stratigraphy, this thick zone yielded obvious evidence of vertically stratified materials. Certain structural features, as well as artifacts, occurred at different elevations and, in some instances, these materials were positioned one on top of the other. The uniformly dark humic soil in which the cultural materials were enclosed did not allow for the recognition of distinct stratigraphic zones within the deposit. The individual placement of structural features and artifacts within the broad cultural zone thus provides the clearest indicator of the stratigraphy of the area deposits. In the following sections, the structural evidences will be discussed by category and in a subsequent section of this report dealing with the stratigraphy of Area 751, they will be considered within the context of their vertical placement.

Postmolds:

A total of nine features were identified in Excavation A which are interpreted to be postmolds within filled post-holes. These features were all identified after the dark humic cultural zone had been removed from Excavation A (Figure 11, Plate 17). The nine postmolds had an average diameter of 0.67 ft, with a range from 0.4 ft to 0.9 ft (Plate 18). They had an average depth of 3.54 ft from the base of the excavation with a range from 2.5 ft to 4.4 ft. Surrounding each of the nine features was a barely discernible 1.5 ft to 2 ft diameter area of earth which contained small amounts of burned earth and charcoal. These may have been postholes which were excavated by the prehistoric inhabitants and immediately filled upon the insertion of the posts. The similar nature of all nine of the postmolds suggests that they are all elements of a single structure or possibly two contemporaneous structures. Six of the postmolds formed a 40 ft arc at the south end of Excavation A. The other three were located at the north end of Excavation A in a somewhat irregular pattern that could be interpreted as an arc. It would appear that the postmolds formed elements of one or more house remains. Significant portions of the structures were evidently lost during earth removal for the construction of the two stabilization ponds.

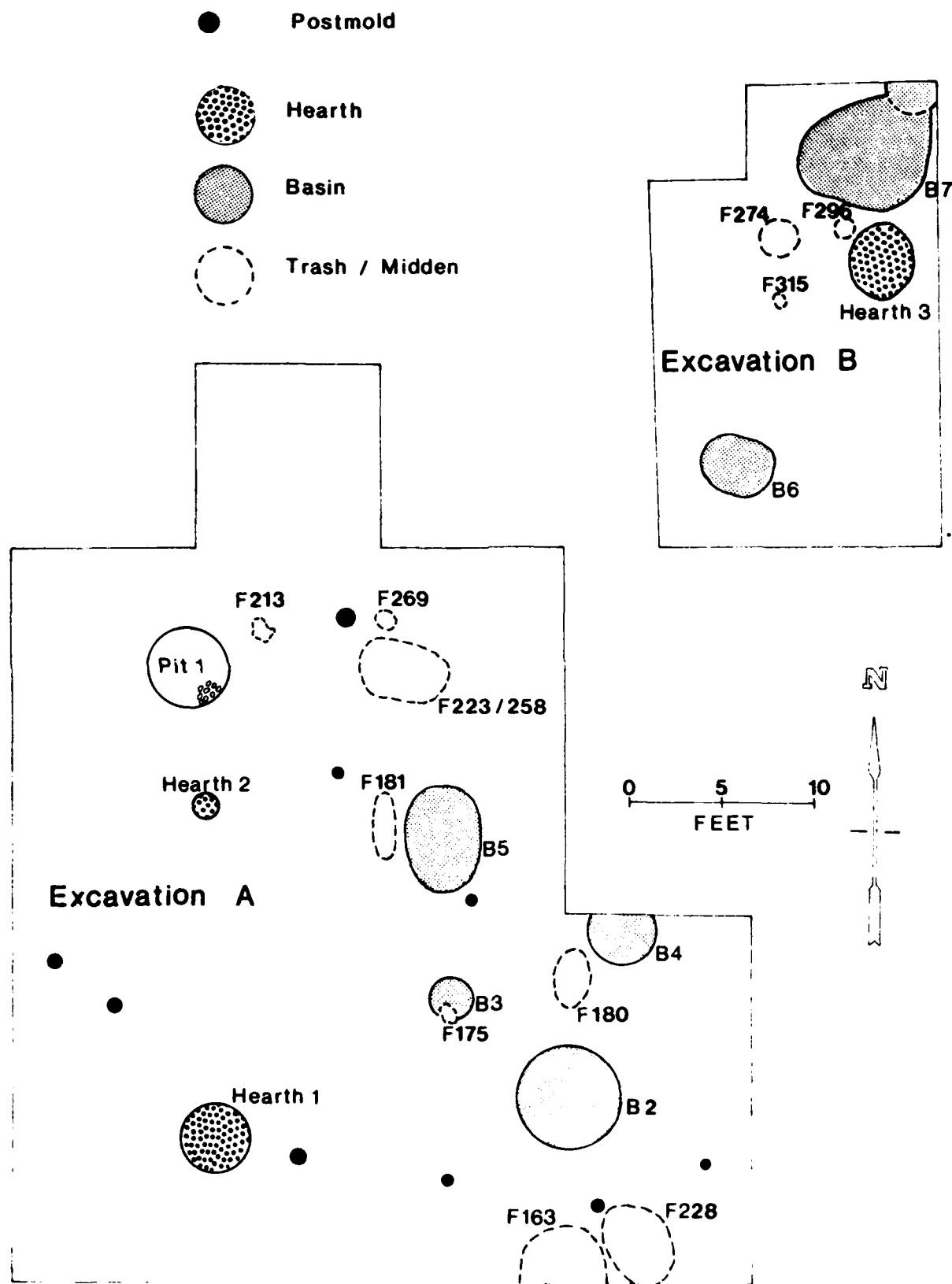


FIGURE 11: 14OS347, Area 751, Excavations A and B, horizontal distribution of structural features



PLATE 17: 140S347, Area 751, base of Excavation A showing cored pits and basins and cross-sectioned postmolds, view to north



PLATE 18: 140S347, Area 751, Excavation A, cross-sectioned postmold

Hearths:

Three hearth areas were identified in the central dike area. Two of these were located in Excavation A and one was located in Excavation B. Hearth 1 (Feature 229) was identified in the southwest portion of Excavation A in X units 1 and 25 (Figure 11, Plate 19). Hearth 1 consisted of a concentration of ash, burned earth, charcoal, burned limestone, potsherds, and bone found in the floor of X1 and extending into X25. The feature showed initially as a circular stain of ash, charcoal, and burned earth at an elevation of 969.82 ft. It had a diameter at the orifice of 3.5 ft. When cross-sectioned, it was found to contain a 0.05 ft thick layer of white ash which was underlain by a 0.3 ft layer of burned earth with a moderate amount of charcoal occurring within the ash (Plate 20). The top of the feature yielded burned bone, small fragments of burned limestone, small pottery sherds and a few chert flakes. The underlying burned earth was mottled tan to black and formed a shallow basin with inward sloping sides. This feature was interpreted to be a hearth with a burned earth lining resulting from fairly long term use. It apparently was prepared as a shallow basin. Interestingly, a fragment of unburned limestone underlay the hearth (0.2 ft below the bottom of the hearth) and this suggests that Hearth 1 represents the terminal part of the occupation of Area 751.

Hearth 2 (Feature 256) was located in the west one-half of X unit 9 in Excavation A and was located at an elevation of 968.88 ft (Figure 11). Hearth 2 was first identified as a concentration of burned limestone rocks in a roughly circular area of 1.1 ft diameter in the floor of X unit 9. When removed, the rocks were found to be underlain by a thin zone of burned earth and charcoal flecks. This was interpreted to be a small rock lined hearth that was set on a level surface rather than in a shallow basin as in the case of Hearth 1.

Hearth 3 (Feature 276) was identified during the excavation of X unit 24 in Excavation B (Figure 11, Plate 21). This feature was identified at an elevation of 968.89 ft. Hearth 3 consisted of an elliptical area of whitish ash which measured 4.0 ft on the north-south axis and 3.5 ft on the east-west axis. This proved to be a hearth set in a shallow basin which was filled with 0.4 ft thickness of ash and underlain by a 0.1 ft layer of burned earth. Lying to the northwest of Hearth 3 was a large concentration of burned limestone which may have been associated with the hearth.

Roasting Pit:

A single roasting pit, Feature 202, was identified during the excavation of Area 751 (Plate 22). This pit was an interesting



PLATE 19: 140S347, Area 751, Excavation A
Hearth 1, before excavation



PLATE 20: 140S347, Area 751, Excavation A,
Hearth 1, cross-sectioned



PLATE 21: 140S347, Area 751, Excavation B,
Hearth 3 before excavation



PLATE 22: 140S347, Area 751, X189, roasting pit
in disturbed north slope of secondary (east) cell

feature that was first identified as a dark soil stain in the southeast corner of X unit 189 in the sloping berm of the easternmost stabilization pond. Several burned freshwater mussel shells were noted within the 1 ft diameter circular stain. This feature was subsequently cored and proved to be a small roasting pit which contained abundant burned mussel shells to a depth of 0.6 ft below the identified orifice and, below this, and extending for another 0.7 ft, was a heavy concentration of wood charcoal. Two chert flakes, fragments of burned limestone, burned earth, a small cobble of river chert, four bone fragments, and a small piece of hematite were recovered within the fill of the feature. The orifice of this pit was identified at an elevation of 967.34 ft. This feature was identified in a severely disturbed condition, as the mussel shell had been initially exposed during construction of the sloping berm in this secondary cell of the sewer facility.

Storage Pit:

A deep storage pit, Feature 312 or Pit 1, was identified during the excavation of Area 751 in X units 13 and 28 in Excavation A. Pit 1 was originally defined as a dark circular stain in the floor of X units 13 and 28 at an elevation of 968.17 ft (Figure 11, Plate 23). The dark stain contrasted markedly with the sterile tan clay which surrounded it. The pit orifice measured 4.5 ft in diameter when initially defined. A small complex of burned limestone, which measured 1.5 ft east-west by 1.3 ft north-south was noted at the east end of the feature at orifice level. The limestone concentration contained rather large cobbles of burned limestone with the largest measuring 1.0 ft in length and 0.3 ft in thickness. When cored, Feature 312 proved to be a deep pit, presumably for storage, which had subsequently been filled with trash. The pit had a maximum depth below the orifice of 4.0 ft. The pit walls sloped inward from the orifice, reaching a maximum constriction at 1.9 ft below the orifice. At this point, a 0.3 ft thick layer of sterile tan silty clay was encountered. The pit walls then flared out, creating a bell shape for the lower portion of the pit. The pit fill, both above and below the sterile tan zone which was encountered midway in the pit, was a dark humic fill which was distinctively different than the tan silty clay into which the pit was excavated. The fill contained charcoal and burned earth flecks throughout. The articulated and nearly complete skeleton of an immature bobcat (*Lynx rufus*) was discovered lying just above the sterile tan cap which was identified approximately half way down in the feature (Plates 24 and 25). The bobcat skeleton was removed by encasing it in a plaster cast and removing it as a unit. Recovered materials within the pit fill included fragments of burned and unburned limestone, sandstone, bone fragments, chert flakes, unmodified river pebbles, an unidentified clay object, potsherds and some unidentifiable bone sections including a portion of a deer mandible, rodent bones, a turtle carapace, and the aforementioned bobcat skeleton.



PLATE 23: 140S347, Area 751, Excavation A, orifice
of Pit 1, (Feature 312), view to west



PLATE 24: 140S347, Area 751, Excavation A, *Lynx rufus* (bobcat) skeleton in Pit 1 (Feature 312)

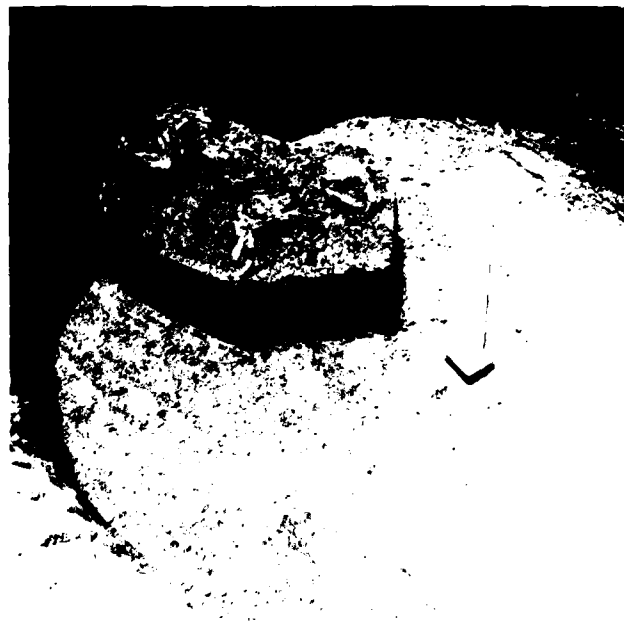


PLATE 25: 140S347, Area 751, Excavation A, *Lynx rufus* (bobcat) skeleton in Pit 1 (Feature 312)

Basins:

A total of seven features were identified in Area 751 which were interpreted to be shallow and usually trash-filled basins. Four of these occurred in Excavation A and two in Excavation B (Figure 11). One large basin complex, Basin 7, was interpreted to be two interesting basins. These ranged in depth from 0.4 ft to an excess of 1 ft below orifice, and they typically had inwardly sloping walls.

Basin 1 (Feature 209), was the only such feature identified outside of the main excavation area in the central dike. Basin 1 consisted of a burned earth concentration with small amounts of charcoal, flecks of burned bone, and chert flakes that was identified in the northwest portion of X unit 189 at an elevation of 966.84 ft. This feature was first identified in the floor of X unit 189 and was then traced back up the north and west walls of the excavation unit. This feature obviously extended to the north and west and apparently its orifice was located somewhat higher than where it was identified. The visible portion of the feature in X unit 189 formed a circular pattern with a radius, from the northwest corner of X unit 189, of 1.1 to 1.6 ft. This feature is interpreted to be a portion of a trash-filled pit or basin. It had a vertical depth of only 0.5 ft, suggesting that it was a trash-filled basin.

Four shallow basins were found within the limits of Excavation A and the remaining two basins were found in Excavation B.

Basin 2 (Feature 253) was a large shallow basin identified in portions of X units 2, 3, 6, and 7 within Excavation A (Figure 11). This was a roughly circular to slightly oval feature with a diameter of 5.5 ft. It was identified at an elevation of 968.63 ft and extended 1.1 ft below this orifice. The fill of this feature was a light tan in color, rather than the more typical dark humic fill contained in most of the other basins. Additionally, the fill within the basin was actually harder than the surrounding soil. The fill contained flecks of burned earth, charcoal, burned and unburned animal bones, and numerous very small chert flakes.

Basin 3 (Feature 286) was located in X unit 6 of Excavation A and was identified at an elevation of 968.25 ft (Figure 11). This basin was shaped like a shallow bowl with inward sloping walls. The basin measured 2.3 ft in diameter at the orifice and had a maximum depth in the center of 0.5 ft. The orifice was defined by the gray-black pit fill, which contrasted markedly with the light tan clay surrounding it. Materials included in the pit fill were charcoal flecks, small fragments of burned clay, a turtle shell section, a small fragment of animal bone, and a piece of burned daub.

Basin 4 (Feature 309) was identified in X unit 7 of Excavation A and extended to the north into an undug portion of the site (Figure 11). This feature was identified during the final skimming of the floor of X unit 7 at an elevation of 968.28 ft. The feature was a very shallow (0.3 ft) circular to oval basin with an estimated diameter of 3.5 ft. The feature contained fill of a slightly darker color than the surrounding sterile soil. In this fill, charcoal flecks, burned earth fragments, and an animal bone section were noted.

Basin 5 (Feature 248) was located in X unit 10 of Excavation A at a depth of 968.60 ft (Figure 11, Plate 26). Feature 248 was initially identified as a soil discoloration, oval in shape, which contained burned limestone, bone, pottery, burned earth and charcoal flecks. The fill of the feature dried and cracked faster than the surrounding soil and was somewhat harder than the surrounding soil. When cored, this feature was revealed to be a sloping sided basin with a maximum depth in the center of 1.3 ft. The feature contained burned earth, charcoal flecks, bone fragments, and a chert biface. The basin measured 5.2 ft north-south and 4.0 ft east-west and a slightly deeper depression occurred in the middle of the relatively flat basin floor. One of the recovered burned earth fragments was apparently a piece of fired daub as it had grass impressions. The fill of the feature also included an incised potsherd, a turtle carapace, and a rodent tooth. A chert spokeshave was recovered from the edge of Feature 248 and was probably a part of the pit fill.

Basin 6 (Feature 308), was located in X unit 19 in Excavation B at an elevation of 967.67 ft (Figure 11, Plate 27). Feature 308 was initially defined on the basis of a very dark soil stain which showed in horizontal section. When cored, this feature proved to be a medium sized, deep, bowl-shaped, slightly out of round pit or basin which measured 3.9 ft east to west, 3.0 ft north to south and 2.5 ft deep. The dark humic pit fill contained a worked bone cylinder, chert flakes, burned earth, charcoal, and animal bone as well as miscellaneous rock.

Basin 7 (Feature 307) apparently consisted of two intersecting basins (Figure 11, Plate 28). This feature was identified in the floor of X unit 31 in Excavation B at an elevation of 968.75 ft. At the orifice elevation, a concentration of burned limestone rock, charcoal, bone fragments, blackened and burned daub, and burned earth was noted in a somewhat irregular pattern. The two basins which underlay this very dark soil stain did not resolve themselves until they had both been exposed to a considerable extent by horizontal skimming with trowels. The larger of the two underlying basins was approximately 7 ft long east to west by 6 ft wide north to south, and the small basin was approximately



PLATE 26: 140S347, Area 751, Excavation A, Basin 5,
cored, with spokeshave (Feature 260), exposed in side,
view to northeast

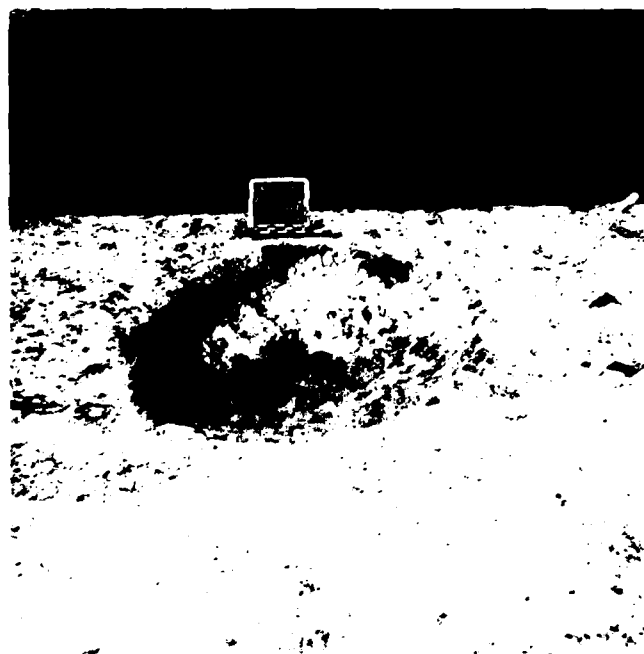


PLATE 27: 140S347, Area 751, Excavation B, Basin 6,
cored, view to west

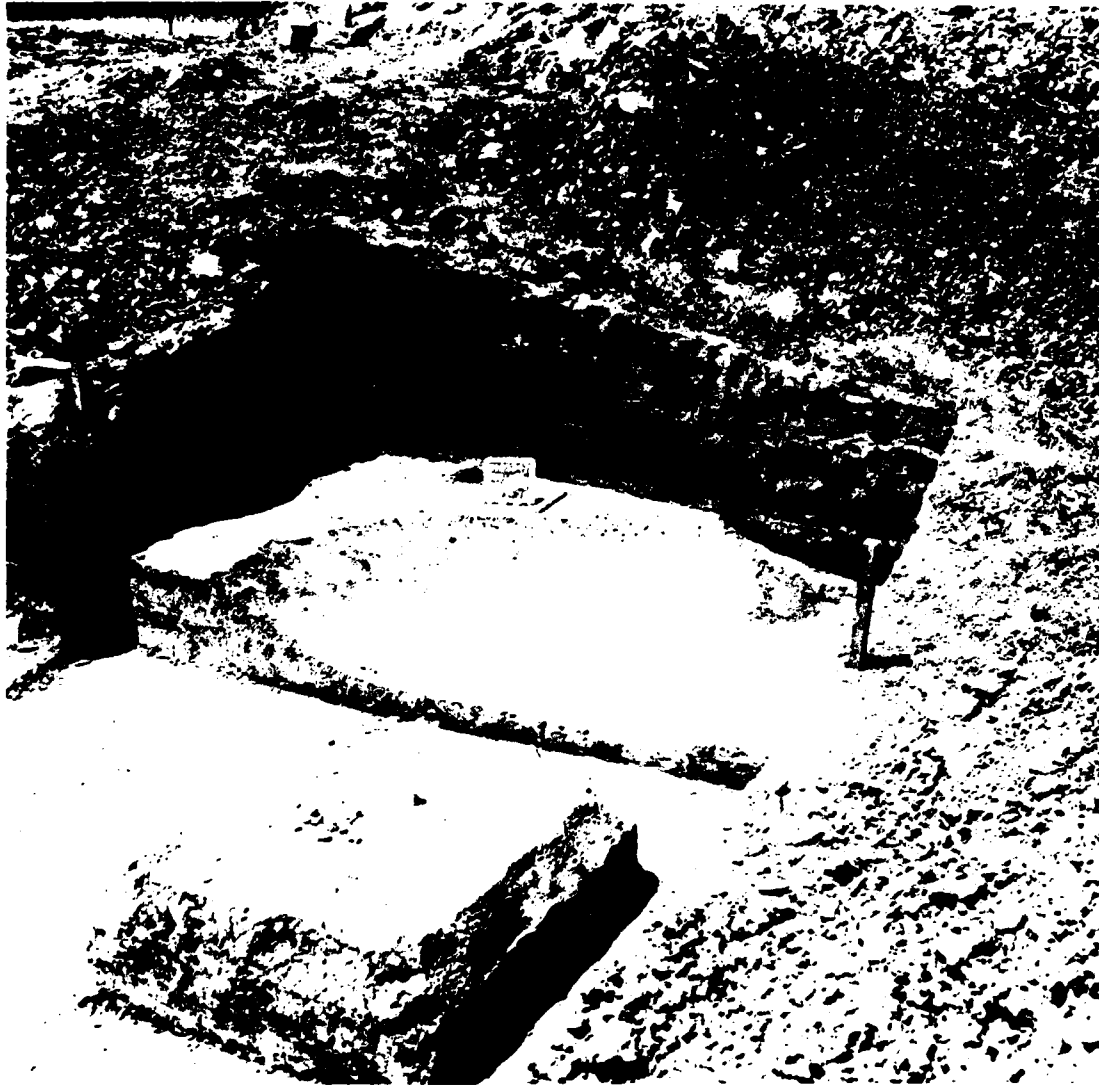


PLATE 28: 140S347, Area 751, Excavation B,
Basin 7, cored and sectioned, view to northwest

3 ft in diameter. The large basin was 1.0 ft deep with sloping sides and the small one was 0.9 ft deep. It appeared that the smaller of the two basins may have been the older, as the larger pit apparently intruded into it. The fill of both basins consisted of a very dark humic soil which contained charcoal, burned earth, concentrations of burned limestone, chert flakes, projectile point sections, potsherds, unmodified stone cobbles and animal bone sections.

Trash Deposits/Middens:

Deposits of discarded materials, including limestone, sandstone, fragments of bone, lithic debitage and sherds, were a common occurrence in Area 751. These trashy areas lacked evidence of placement in intentionally prepared basins or pits but, in some cases, the thickness of the trash suggested repeated use of certain areas as trash depositories. Other complexes of discarded materials, i.e., certain sherd and bone complexes, suggested single event placement. In one instance, the placement of a complex of burned limestone adjacent to Hearth 3 suggested a functional relationship between the hearth and the burned stone. Limestone was the most frequently observed material in the trash and a high percentage of the limestone was obviously thermally altered. The typical limestone was rich in fossils and exhibited a red color when oxidized and a yellow color in an unoxidized state.

The largest complex of trash encountered in Area 751 occurred in the north wall of the westernmost of the stabilization ponds in X units 192 and 193. A total of four features (198, 201, 203, and 206) was recorded in the north half of X units 192 and 193 during excavation (Plates 29 and 30). During the analysis of the Area 751 material, the homogeneity of these features became evident. All consisted of nearly identical types of trash occurring in a fairly constricted area of the site. None of the four identified features yielded evidence of trash placement in prepared basins. Feature designations were made on the basis of the intensity of the concentration of discarded materials. The matrix in which all of these materials was found consisted of a very dark humic soil of a darker shade than the underlying soil. It appears that these feature complexes represent a midden or trash deposit that was thickest to the north, where it extended into the undug portion of the sloping berm. What the four assigned features appear to represent are lobes of a midden extending to the south and exposed in the sloping cut of the berm. Materials recovered from the midden deposit included concentrations of burned limestone, unburned limestone, burned earth, charcoal flecks, chert flakes, burned and unburned bone, shell fragments, clay tempered and burned limestone tempered ceramics, etc. A partially articulated unburned portion of a deer leg (metatarsal, calcaneus and astragalus), was also contained within the midden complex.



PLATE 29: 140S347, Area 751, Midden in
X192 & 193, view to north

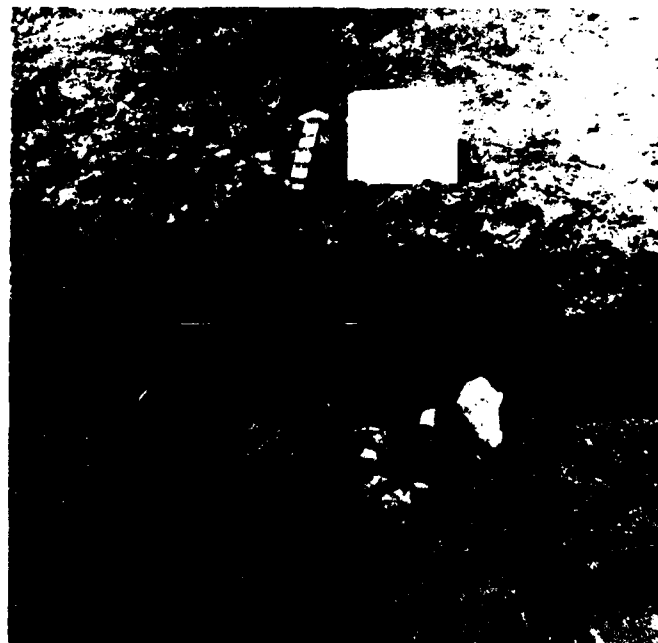


PLATE 30: 140S347, Area 751, Midden in
X192 & 193, view to north

Another midden area (Feature 127) was encountered during the November, 1974, cutting of the connecting trench between the two stabilization ponds (Plate 10). This complex was an apparent midden area identified at a basal elevation of 968.60 ft. The exposed portion of the midden had an east-west horizontal extent of 3.4 ft. The north-south extent could not be determined because this feature complex was encountered within the 2.0 ft wide connecting trench and materials extended into both the north and south walls. No evidence was encountered to indicate that this trash midden occurred in a basin or pit although the deposit, had a vertical thickness of 0.6 ft. The complex included burned and unburned limestone fragments, chert river cobbles, chert cores and flakes, burned earth, animal bone fragments, a potsherd, a thin triangular biface, and a bird bone bead.

A total of 11 trash or midden complexes were identified in the main Excavations A and B in the central dike area (Figure 11). These range from small complexes of a few sherds or bone sections, to quite large complexes of stone, bone, and trash.

Feature 163 consisted of a concentration of burned limestone identified in the southeast corner of X unit 2 and the southwest corner of X unit 3 in Excavation A at an elevation (to the base of the feature) of 969.04 ft (Figure 11). A portion of this feature extended to the south into an unexcavated area of the site. This feature had a maximum east to west dimension of 4.0 ft. Twenty limestone cobbles, ranging in size from 0.1 ft to 0.6 ft in diameter were recovered from the feature. One limestone rock has a badly weathered hole of 2.5 cm diameter in it. Because of the very friable nature of the limestone, a determination could not be made as to the origin of the hole. While fragments of burned earth and charcoal were found in association with the limestone rock complex, there was no evidence of in situ burning. Apparently, this feature complex was a refuse area.

Feature 228 was a complex of burned limestone, small charcoal flecks, burned earth flecks, burned and unburned small bone fragments, chert flakes, and potsherds found in the floor of X unit 3 in Excavation A at an elevation of 968.95 ft (Figure 11, Plate 31). This feature was located just to the northeast of Feature 163 and at a slightly greater depth. The 46 recovered limestone rocks found in this feature ranged in size from 0.1 to 0.5 ft in diameter. These occupied an irregularly circular area approximately 4.2 ft in diameter. Culturally mixed soil, containing small flecks of charcoal and very small flecks of burned earth, continued down 0.25 ft to 0.5 ft below the base of this feature. Thus, it is possible that this was a hearth or fireplace area which received fairly light burn activity. However,



PLATE 31: 14OS347, Area 751, Excavation A, Midden (Feature 228), limestone rock complex, view to south



PLATE 32: 14OS347, Area 751, Excavation A, Midden (Feature 180), stone, bone, charcoal, burned earth, view to south

it lacked firm evidence of in situ burning and, furthermore, the presence of fragments of unburned bone in the feature fill does not accord well with an interpretation of this feature as a hearth. A more cautious, and probably more plausible explanation, is that this feature complex is simply a cluster of burned rock and other materials that were secondarily deposited by the inhabitants and that it may represent the cleaning out of hearth areas.

Feature 175 included a complex of 12 potsherds, two utilized chert flakes, 10 unmodified flakes, 12 animal bone sections (some burned), three mussel shell fragments, one hammerstone, three burned earth fragments, six burned limestone fragments, and one piece of sandstone (Figure 11). This material was found in X unit 6 in Excavation A at an elevation of 968.70 ft and it occupied an approximately 2.0 ft north-south by 1.6 ft east-west area. This feature was identified just 0.45 ft above the orifice of Feature 286, a shallow basin, and it may be associated with that basin.

Feature 180 consisted of a complex of burned limestone, bone, charcoal and burned earth identified in X units 6 and 7 in Excavation A at an elevation of 968.83 ft (Figure 11, Plate 32). The feature yielded 11 burned limestone rocks, one chert flake, 13 bone fragments (some burned) and a fragment of burned earth. At least four of the recovered bone sections are deer metatarsal sections. The soil comprising the feature was a dark humic soil that occupied an area approximately 1.7 ft east to west and 3.2 ft north to south.

Feature 181 consisted of a complex of smooth surfaced, indurated clay tempered potsherds and associated materials found in X units 9 and 10 of Excavation A at an elevation of 968.60 ft (Figure 11, Plate 33). Recovered materials included nine potsherds, five pieces of burned limestone, eight sandstone fragments and one bone fragment. The materials were found within an area 1.0 ft east to west and 3.4 ft north to south.

Feature 213 was a rather ill defined complex that occurred in X unit 13 of Excavation A at an elevation between 970.04 ft and 969.29 ft. This feature consisted of a complex of wood charcoal and dark humic soil that occupied an area approximately 1.2 ft north to south by 1.6 ft east to west. The stain extended down 0.5 ft below the identified top of the feature. While this could have been a rodent burrow, the horizontal placement of the charcoal suggests that it represented elements of a burned and fallen timber.



PLATE 33: 140S347, Area 751, Excavation A, Midden
(Feature 181), sherds and stone, view to east

Feature 223/258 consisted of a complex of stone, bone and sherds identified in X units 13 and 14 of Excavation A at an elevation of 968.47 ft (Figure 11). Materials recovered from the feature included 105 bone sections (some burned), six chert flakes (one utilized), 26 limestone rocks, seven sandstone rocks and three potsherds. Recovered bone materials included several sections of turtle carapace and rodent bones as well as sections of larger mammal bones. The materials occupied an area 5.0 ft east to west by 3.0 ft north to south.

Feature 269 consisted of a complex of potsherds, burned limestone, bone and chert. Feature 269 was located in X units 13 and 14 of Excavation A at an elevation of 968.42 ft (Figure 11). The complex occupied an approximately 1 ft diameter area. Recovered materials included one chert flake, 21 bone sections (including several turtle carapace sections), four body sherds, and two limestone rocks.

Three trash deposits were identified in Excavation B of Area 751. These included Feature 274, Feature 296, and Feature 315. Feature 274 consisted of a complex of bone and stone identified in the floor of X unit 24 at an elevation of 968.74 ft (Figure 11, Plate 34). Feature 274 was located to the west of Feature 276, Hearth 3. Materials recovered from Feature 274 were found in an area approximately 2.0 ft in diameter and included a section of split antler, 11 turtle carapace sections, 11 additional bone sections, 10 chert flakes, one chert core, one unmodified chert river cobble, and a fragment of burned earth.

Feature 296 was also identified in X unit 24 of Excavation B immediately northwest of Hearth 3 (Figure 11, Plate 35). The base of this feature was at an elevation of 968.19 ft. In the approximately 1 ft diameter area which comprised the feature complex area, 61 rim and body sherds, 11 sandstone fragments, 19 burned limestone fragments, 15 bone fragments, eight chert flakes, two fragments of fired daub, and one burned earth fragment were recovered.

Feature 315 was also identified in X unit 24 of Excavation B and had a basal elevation of 967.69 ft. This feature consisted of a small complex of bone which included one bone section and a number of bone fragments in an area 0.7 ft by 0.4 ft.

Artifacts

Ceramics:

Ceramic artifacts recovered from Area 751 at the Cow-Killer site included sherds and sherd sections from a large number of



PLATE 34: 140S347, Area 751, Excavation B, Midden
(Feature 274), stone, bone and antler



PLATE 35: 140S347, Area 751, Excavation B, Midden
(Feature 296), sherds, stone, daub, burned earth

vessels, a few small fragments of tempered and fired clay which may be sherds but which could also be sections of clay pipes, and two unidentifiable fired clay objects. Witty (1980) and Reynolds (1979) have noted that ceramics are one of the most consistent indicators for a Greenwood phase occupation. Specifically, the presence of cord-roughened or smoothed sherds which contain burned and crushed limestone tempering particles has been noted at all four of the Greenwood phase sites which have been excavated to date. These sites include the Curry site, 14GR301, the Two Dog site, 14M0301, the Gilligan site, 14CF332, and the Cow Killer site, as well as a number of sites in the proposed Cedar Point reservoir area which were tested by a Society crew in 1976 (Calabrese 1967, Witty 1980, Reynolds 1975, Wood 1977). Area 751 yielded a total of 403 pottery sherds and three possible small sections of clay pipes. Sherds recovered during the actual excavation of Area 751 account for 90.6 percent of the total of recovered sherds, while 9.4 percent of the recovered sherds were found on the disturbed surface of the construction cuts for the two stabilization ponds. Vessel sections recovered during the excavation include 15 rim sherds (3.7 percent of total), 383 body sherds (95 percent of total) and 5 obvious base sherds (1.3 percent).

The initial inspection of the sherds was conducted macroscopically with the sample then sorted into categories on the basis of temper, exterior surface finish, and vessel form. All sherds were then examined under a binocular microscope with variable magnification from 3X to 40X power. Comparisons were made with published and unpublished accounts of similar ceramics as well as with actual specimens from other sites in the Society collections. For example, the identification of bone temper in two sherds was made on the basis of comparison with recovered ceramics from the Cedar Point reservoir in Chase county. The Chase county sherds had been identified as being bone tempered by X-ray diffraction analysis and differential thermal analysis (Wood 1977:90-93). Simple chemical tests, such as the application of dilute hydrochloric acid to suspected shell and limestone temper particles was performed, and the hardness of sherds was estimated by a simple mineral scratch test with the Mohs' hardness scale. The Mohs' scale is relatively imprecise and the hardness of the sherds is individually quite variable due to the amount and type of temper. For instance, grit or sand tempered sherds must be tested with care to ensure that the mineral scratch test is being performed on the clay matrix rather than on the tempering particles. This is difficult to perform when temper is abundant.

Study of the ceramic sample suggested that three factors were of particular importance in terms of classification of the materials into categories. The three factors which were

considered to be most important were predominant temper, exterior surface treatment, and probable vessel form. Temper or aplastic additives found in the Area 751 ceramics included crushed and burned limestone, grit, shell, sand and indurated clay. There is at least a strong suggestion that the indurated clay particles found in some of the ceramics are residual shale elements and should not be considered to be a tempering additive. Nevertheless, they are an observable and perhaps significant feature in at least a portion of the sherd samples. In addition, some of the ceramics from Area 751 appear to lack temper entirely. External surface treatment on the Area 751 sherds ranged from those with cord marked surfaces, smoothed over cord marked surfaces, smooth surfaces and smoothed and polished surfaces. A clay slip was also noted on a few sherds. Two distinct vessel shapes were represented by the majority of the sherds from Area 751. The first type apparently has a conoidal shape with thickened and pointed base, relatively straight to somewhat outwardly bulging sides, slight neck constriction, and straight to slightly everted rims. Sherds exhibiting this vessel shape were typically the thicker sherds found at the site. The second vessel shape presented in the sample is a globular vessel form with a rounded base, bulging sides, constricting neck, and outwardly flaring or sometimes straight, simple and unthickened rim.

By further subdividing the sherd sample from Area 751 on the basis of temper and exterior surface finish, three somewhat distinctive ceramic categories, A, B, and C were recognized (Table 5). Category A sherds constituted 13.7 percent of the total of sherds recovered from Area 751 while Category B comprised 38.9 percent and Category C was 29.2 percent. The remaining sherds were classified either as Category D or indeterminate.

TABLE 5: 140S347, AREA 751 CERAMIC CATEGORIES

CATEGORY A (Conoidal base pots with straight or bulging sides and little or no neck constriction)

Burned Limestone Temper (sample size 55)

Cord marked exterior surfaces (sample size 27)

Smoothed over cord marked exteriors (sample size 7)

Smoothed exteriors (sample size 7)

Polished exteriors (sample size 7)

Indeterminate exterior (sample size 7)

CATEGORY B (Conoidal base vessels with bulging sides, slight neck constriction, straight to slightly everted, simple, unthickened rims)

Sparse inclusions of clay (indurated shale particles probably) (sample size 156)

Smoothed exteriors (sample size 151)

Smoothed exteriors with slip (sample size 5)

CATEGORY C (Globular vessels, constricted neck, everted or straight rim, simple unthickened rims) (sample size 117)

Abundant inclusions of clay (indurated shale particles probably)

Cord marked exteriors (sample size 38)

Sparse inclusions of clay (indurated shale particles)

Cord marked exteriors (sample size 77)

Bone temper

Cord marked exterior (sample size 2)

CATEGORY D (Indeterminate shape) (sample size 26)

Sand and/or finely crushed grit particles (some are rounded, some angular)

Cord marked exteriors (sample size 5)

Smoothed exteriors (sample size 19)

Shell temper (small, much fragmented)

Smoothed exteriors (sample size 2)

MISCELLANEOUS CERAMICS: (Forty-seven small sherds for which temper, vessel shape and surface finish cannot be determined)

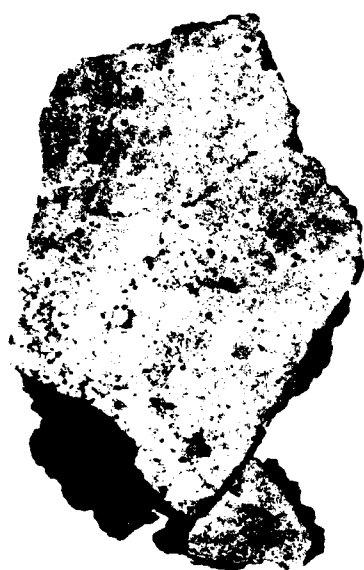
Category A consisted of thick walled, conoidal base pots with bulging sides and slight neck constriction. The predominant tempering additive for the Category A ceramics consisted of fragments of crushed and burned limestone. The limestone particles exhibited a white to reddish color and were abundant. In a number of cases, the burned limestone particles had leached or in some other manner been removed from the sherd sections, leaving small cells or holes where they had originally been located. Surface finish on the Category A sherds ranged from cord marked exteriors to smooth and even polished exterior surfaces (Plate 36, A-E).

Category B ceramics exhibit basically the same vessel shape as the Category A ceramic materials, but they lack any evidence of burned limestone temper. The only inclusion noted in the Category B ceramics consisted of sparse inclusions of apparently indurated shale particles and small sand particles that appeared to be natural to the raw clay. There is a possibility that the indurated clay particles are actually crushed sherds. Category B ceramics exhibit either smoothed exteriors or, in some cases, smooth exteriors with a slip (Plate 37, A-G and Plate 38, A-C). Category C vessels exhibit a different vessel shape from either Category A or Category B.

The Category C vessel shape seems to be that of globular vessels with constricted necks and everted or straight, simple and unthickened rims. A number of the Category C sherds exhibit abundant inclusions of indurated shale particles and a still larger percentage have sparse inclusions of indurated shale. A very minor tempering additive in the Category C ceramics was bone temper. All Category C ceramics have cord marked exterior surfaces (Plate 39, A-D). A fourth category, Category D, is composed of either sand or shell tempered sherds for which the vessel shape could not be determined. It comprised 6.5 percent of the sherd total from Area 751. Forty-seven additional sherds from Area 751 (11.7 percent of total), could not be placed into any of the above mentioned categories because they were so small that the temper, vessel shape, and exterior surface finish could not be determined.

Category A Ceramics: Sample size 55
Paste Characteristics

Temper: The predominant tempering additive consists of abundant particles of crushed and burned limestone which range in color from white (Hue 10YR 8/1) to light gray (Hue 10YR 7/1). In some cases, the particles are partially or totally absent, leaving numerous small and irregularly shaped cavities. This presumably occurred either due to leaching action or as a result of overfiring for this particular type of temper. The limestone tempering particles



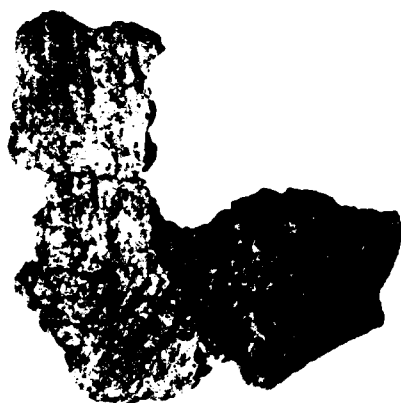
A



B



C



D



E



PLATE 36: 140S347, Area 751, Category A ceramics

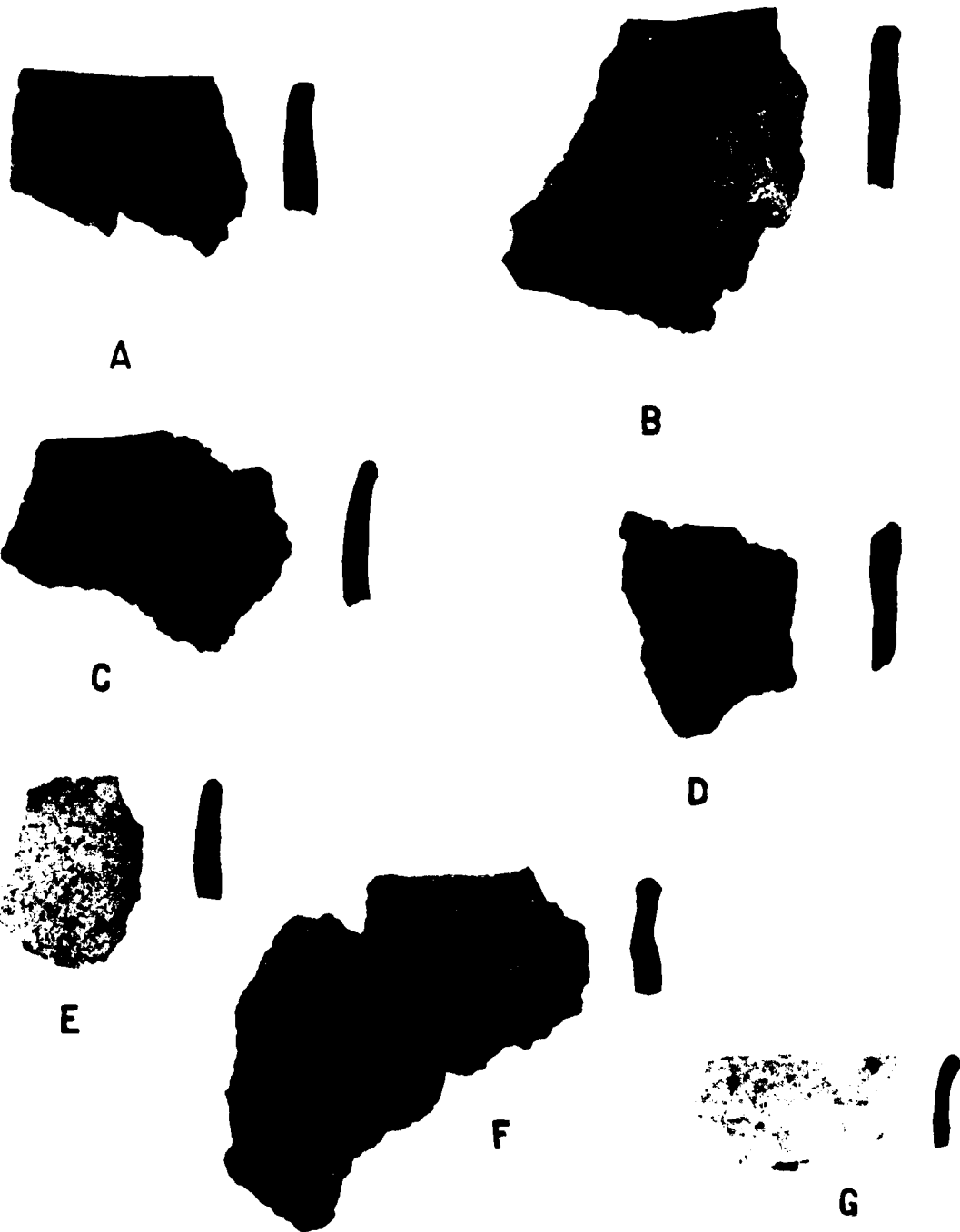
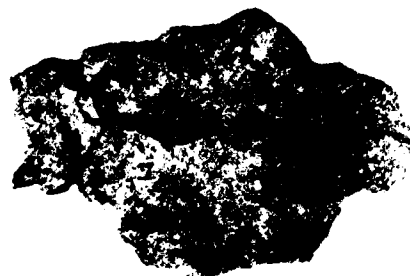


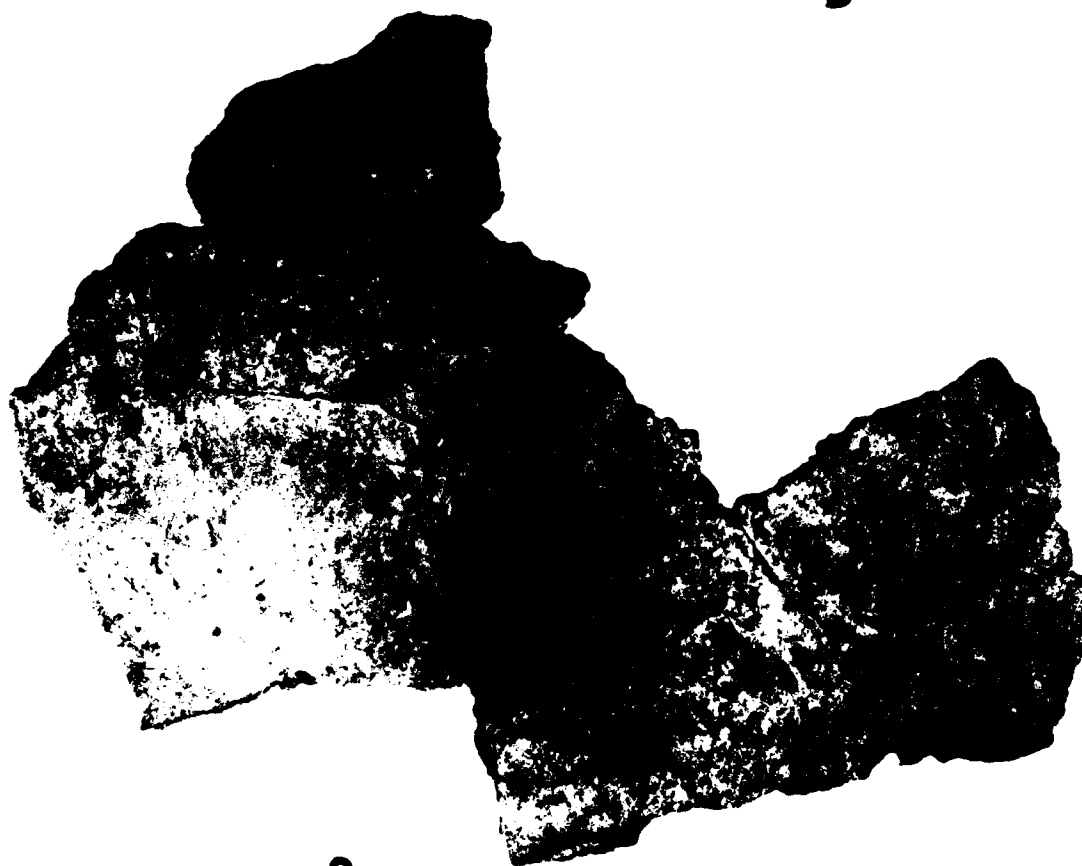
PLATE 37: 140S347, Area 751, Category B ceramics, rimsherds



A



B



C



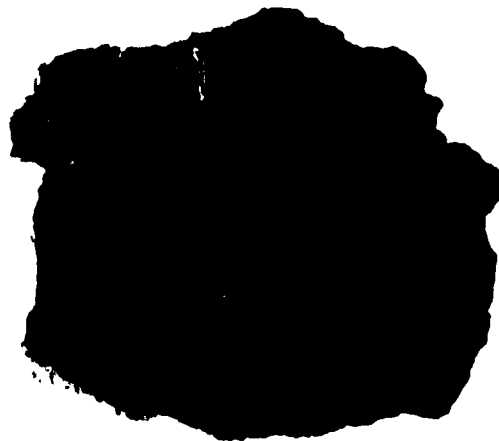
PLATE 38: 140S347, Area 751, Category B ceramics



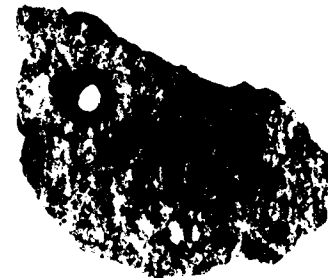
A



B



C



D



PLATE 39: 140S347, Area 751, Category C ceramics

range in size from less than 1 mm to 5 mm in diameter. A number of specimens reveal incomplete leaching with a residue of limestone present in the irregular cavities. In addition to the predominant crushed limestone temper, small sand particles and occasional indurated clay particles are apparent in fresh breaks and on the surface of the sherds. Other small brown inclusions noted may represent ferruginous material. The sparse nature of these sand, shale and ferruginous particles suggests that these are not tempering additives, but are a natural residue of the clay.

Texture: While the sherds in this category have a fairly large particle size for tempering materials, ranging up to 5 mm in diameter, surface texture is rather fine. This is apparently a result of the friable nature of the limestone tempering particles and is also a result of finishing processes such as smoothing and polishing.

Hardness: The sherds of this category measure approximately 2 (gypsum) to 3 (calcite) on the Moh scale of hardness.

Color: The exterior surface color in this sherd sample is fairly consistent and includes very pale brown (Hue 10YR 7/4), light yellowish brown (Hue 10YR 6/4), pale brown (Hue 10YR 6/3), and grayish brown (Hue 10YR 5/2). Firing clouds are not readily apparent on the sherd sample. Interior surface coloration is more variable with sherds exhibiting light brownish gray (Hue 10YR 6/2), light yellowish brown (Hue 10YR 6/4), very pale brown (Hue 10YR 7/4), and very dark gray (Hue 10YR 3/1). One sherd interior has a heavy incrustation of carbon on it. The cores of the sherds are most commonly two colored with the exterior one-half usually approximating the exterior surface color and the interior one-half approximating the interior surface color.

Method of Manufacture: The sherd sample yields little or no data as to the method of manufacture. The uneven fracture pattern revealed in the sherd sample suggests either a lump molding process or broad and well joined coils. The manufacturing technique may very well have involved a combination of these two methods.

Surface Finish: The external surface finish of the Category A sherds is quite variable with 27 of the sherds (49.2%) exhibiting cord marked exterior surfaces (Plate 36, D-E) and with seven examples (12.7%) of each of the following; smoothed over, cord marked exteriors (Plate 36, B-C), smoothed exteriors, polished exteriors (Plate 36, A), and indeterminant exterior surface finish. The cord marked surfaces were apparently constructed with a simple two-ply twist of cord wrapped around a rod. The cord wrapped rod was then apparently rolled over the exterior surface. Several specimens have a cross cord marked surface where the rod was apparently first rolled in one direction and subsequently rolled at an approximately 90° or oblique angle to the original marks. Orientation of the cord markings in terms of the vessel shape is difficult to determine. Some of the cord marked surfaces exhibit a less distinct pattern than others, suggesting partial or incipient smoothing of the exterior surfaces. Seven sherds exhibit obvious partial smoothing of the cord marked surfaces. The object used to achieve this smoothing could not be determined. Two sherds within this category exhibit scraping or wiping marks from a fairly sharp edged tool (possibly a mussel shell). Seven additional sherds have surface finishes that are completely smoothed and lusterless. Seven other sherds have exterior surfaces that are completely smoothed and slightly light reflective, suggesting polishing. The interior surfaces of all the Category A sherds are uniformly smoothed. Two sherd interiors exhibit discontinuous parallel striations, suggesting thinning and scraping with a sharp edged tool such as a mussel shell.

Form Characteristics:

Vessel Shape: The largest Category A sherd, which measures 108 mm by 74 mm appears to be a body sherd from the lower portion of a conoidal vessel (Plate 36, A). It has a thickness varying from 9 mm at the top portion to 14 mm near the bottom and it curves in at the bottom. The small size of the remaining sherds and sherd sections (the largest is 75 mm by 80 mm) makes it somewhat difficult to determine a vessel shape, but the larger sections, and the thick basal sherds suggest that these were conoidal vessels with relatively straight or slightly outwardly bulging sides and little or no neck constriction.

Rim: There are no rims in this sample.

Thickness: Sherds in this sample range in thickness from 7 mm to 15 mm with individual sherds sometimes showing marked differences in thickness from top to bottom.

Vessel Size: The diameter and height of the Category A vessels can only be inferred by the relatively flat curve of the body sherds to be medium to large sized vessels, probably conoidal jars.

Decoration: No decoration is present in the sample unless the presence of polishing on seven sherds is considered to be a decorative technique.

Appendages: No appendages are present in the sample.

The horizontal and vertical provenience of the Category A sherds from Area 751 is included in Table 6. The general provenience for the Category A ceramics is interesting on a grid plot (Figure 12). A significant number of Category A sherds were recovered from Excavation A of the central dike, while very few were found in Excavation B. Another large number of Category A sherds was recovered from X units 192 and 193, both located on the sloping north berm of the westernmost stabilization pond. The vertical provenience of the Category A sherds ranges from an elevation of 967.67 ft to 970.33 ft.

TABLE 6: 140S347,
Area 751, Distribution of Category A Sherds

Number of Specimens	Horizontal Location (by X unit)	Vertical Location (elevation in feet)
22	Surface Excavation A	
1	X-25	968.65 to 969.15
1	X-1	969.65 to 970.15
1	X-2	968.25 to 968.57
3	X-5/6	967.99 to 969.77
2	X-7	968.39 to 968.89
2	X-13	969.54 to 970.04
3	X-17	968.67 to 969.17

TABLE 6: 140S347,
Area 751, Distribution of Category A Sherds
(Continued)

Number of Specimens	Horizontal Location (by X unit)	Vertical Location (elevation in feet)
Excavation B		
1	X-19	967.67
Other		
17	X-192/193	969.80 to 970.33
1	backhoe trench (F 127)	968.60
—		
55 Total		

Category B Ceramics: Sample size 156 (11 rim sherds,
145 body and base sherds)

Paste Characteristics

Temper: Category B sherds are hard and fairly well compacted. The sherds in this category may lack intentional tempering additives, although they do contain small amounts of indurated clay particles and sparse rounded sand particles. The indurated clay particles show up as either light or dark colored particles. These particles, when present, range from less than 1 mm to 4 mm in diameter.

Texture: The sherds in this category have a fairly fine texture with uneven fracture lines.

Hardness: Category B sherds range in hardness from 2 (gypsum) to 3 (calcite) on the Moh scale.

Color: The exterior surface colors of most of the sherds in this category range from a light yellowish brown (Hue 10YR 6/4) to a grayish brown (Hue 10YR 5/2). Five sherds, which appeared to have a clay slip on their exterior surfaces, exhibit a slightly different coloration. For these sherds, the normal exterior surface color is pale brown (Hue 10YR 6/3). The applied slip is of a light brown color (Hue 7.5 YR 6/4). No noticeable firing clouds were observed

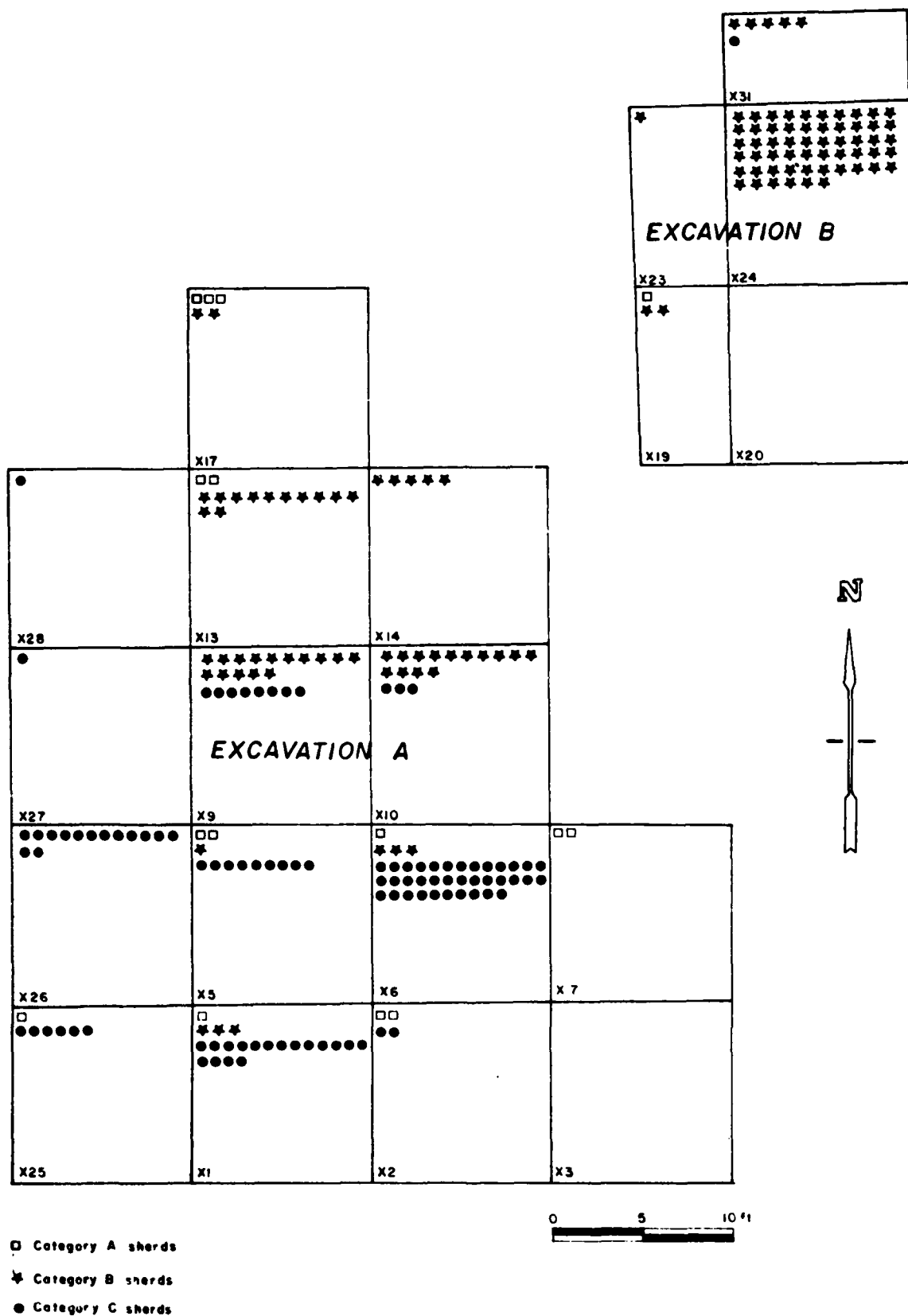


FIGURE 12: 140S347, Area 751, the horizontal distribution of Category A, B and C sherds in Excavations A and B

on the Category B sherds. The interior surface color of the sherds is the same as the exterior color. The core color, as exhibited in freshly broken cross-sections, is typically a dark gray (Hue 10YR 4/1). None of the sherd interiors exhibited any evidence of a burned residue of any kind.

Method of Manufacture: Several large sherd sections exhibit horizontal breaks perpendicular to the vertical orientation of the vessel section. These sherd sections also exhibit swelling in concentric patterns which form notable horizontal bands, suggesting that the manufacturing technique for at least the upper portion of the vessel sections was that of broad coiling (Plate 38, C). The four recovered base sherds are quite thick and appear to be lump molded. Thus, a hypothetical reconstruction of the manufacturing process would include lump molding of the bases with an application of broad, interrupted, coils to form the body of the vessel.

Surface Finish: All exterior surfaces are completely smoothed and some are lightly polished (Plate 37, A-G, Plate 38, A-C). Five sherds have what appears to be a clay slip on the smoothed exterior surfaces. This manifests itself as a thin and discontinuous layer of clay adhering to vessel surfaces (Plate 38, A-B). As indicated earlier, this clay slip is of a slightly lighter color than the main clay body. The interior surfaces of the Category B sherds are smoothed. Several interior sherd sections exhibit discontinuous horizontal striations, suggesting that they were scraped and thinned with a sharp edged tool like the somewhat irregular edge of a mussel shell.

Form Characteristics:

Vessel Shape: Body sherds, base sherds and rim sections (the largest body sherd section is 180 mm by 145 mm) suggest tall, slightly outwardly flaring rims, slightly constricted necks, bulging sides, and conoidal bases. The thickest portion of the vessels is at the base. Category B ceramics appear to share the same vessel shape characteristics as Category A sherds.

Rims: Eleven rim sherds are contained in the Category B ceramic sample (Plate 37, A-G). These are typically simple, unthickened rims, slightly everted, with flattened

or rounded lips. Six rim sherds have simple, unthickened rounded lips and five have flattened lips. On one example, the flattening is at an oblique angle to the rim height. Rim exterior surfaces are smoothed and interior surfaces are also smoothed, but less carefully. Six rim interior surfaces have horizontal to oblique scraping striations. One sherd is an all over dark gray color (Hue 10YR 4/1) and has dark gray particles of clay adhering to it, suggesting that it was smothered in a fire.

Thickness: The sample ranges from 6 mm to 12 mm in thickness. The body sherds averaged 6 mm to 8 mm in thickness while basal sherds range up to 12 mm thick.

Vessel Size: Although a precise estimation of the vessel size cannot be made due to the absence of restorable vessels, the curvature of sherds suggests that medium to large size jars are represented in the sample.

Decoration: No decorations are present in the sample.

Appendages: No appendages are present in the sample.

The horizontal and vertical provenience of Category B ceramics is presented in Table 7. It will be noted that Category B sherds were recovered from both Excavation A and Excavation B as well as from excavation unit 191, a 5 ft by 10 ft test in the north sloping berm of the west stabilization pond. The heaviest concentration of Category B sherds comes from the 350 square ft area of Excavation B where the Category B ceramics comprise the single largest category of ceramics recovered (Figure 12).

TABLE 7: 14OS347,
Area 751, Distribution of Category B Sherds

Number of Specimens	Horizontal Location (by X unit)	Vertical Location (elevation in feet)
22	Surface (1 is from X106, an early test in the central dike) Excavation A	
3	X-1	968.22 to 970.15

TABLE 7 (Continued)

Number of Specimens	Horizontal Location (by X unit)	Vertical Location (elevation in feet)
1	X-5	969.47 to 969.97
3	X-6	967.99 to 970.19
15	X-9	967.98 to 970.18
14	X-10	968.16 to 969.66
12	X-13	967.54 to 970.04
5	X-14	968.27 to 969.17
2	X-17	968.07 to 969.17
Excavation B		
2	X-19	968.41 to 968.91
1	X-23	- - - - -
56	X-24	967.41 to 968.91
5	X-31	968.75
Other		
34	X-191	967.47 to 969.47
158 Total		

Category C Ceramics: Sample size 117 (114 body sherds and three rim sherds are represented in the Category C sample)

Paste Characteristics

Temper: Seventy-seven of the Category C sherds (65.82%) appear to lack intentional tempering additives. These sherds contain occasional small (less than 1 mm to 2 mm) particles of rectangular to triangular-shaped pieces of indurated clay as well as occasional rounded sand grains.

Thirty-eight sherds (32.47%) contain abundant particles of indurated clay which range in size from 1 mm to 4 mm and which are typically triangular to rectangular in shape. These sherds also contain sparse quantities of presumably natural rounded sand grains. Whether the indurated clay particles are an intentional additive or a natural occurrence in the clay is not certain. Two sherds (1.7%) lack any evidence of indurated clay particles, but contain moderate amounts of burned and crushed bone temper (particles up to 3.5 mm in size).

Texture: The surface texture of the Category C sherds is uniformly fine. Core textures range from compact to laminated.

Hardness: The sherds of this category range in hardness from 2 (gypsum) to 3 (calcite) on the Moh scale.

Color: Exterior surface color of the Category C sherds is quite variable and many firing clouds were observed on the exterior surfaces of the sherds. Exterior coloration includes reddish yellow (Hue 7.5YR 6/6), light yellowish brown (Hue 10YR 6/4), dark gray (Hue 10YR 4/1) and dark grayish brown (Hue 10YR 4/2). The interior surface color of the sherds exhibits the same characteristics as the exterior, with a tendency towards the darker colors and including some sherds that are a very dark gray in color (Hue 7.5YR N3/). The sherd cores exhibit the same color varieties as the exterior and interior surfaces, with a tendency for the darker colors to predominate.

Method of Manufacture: There is no clear indication of the method of manufacture.

Surface Finish: All of the sherds in the Category C sample have cord marked exterior surfaces (Plate 39, A-D). The cord marking, particularly on rim, neck and upper body sherds, is oriented in a vertical direction. Several examples of body sherds exhibit criss-cross cord marking. The cord impressions are generally medium gauge in size and quite distinct. Interior surfaces are typically irregularly and somewhat carelessly smoothed, and a number of specimens exhibit horizontally incised, irregular scraping or thinning marks, particularly near the rim.

Form Characteristics

Vessel Shape: Medium sized globular vessels with constricting necks, slightly flaring rims, bulging shoulders and bodies and round bottoms are indicated by the sherd sample. The flared rims are inferred from neck and shoulder sections.

Rims: Three rim sherds are contained in the Category C ceramic sample. One rim sherd, of indeterminate height, has vertical cord markings on the exterior surface and is smoothed and scraped on the interior (Plate 39, A). This rim is straight and unthickened and is flattened on the lip. Four tool impressions occur on the lip at an oblique angle. These impressions are 4 mm wide, 2 mm deep, and resulted from the impressing of a horizontally held, blunt pointed rod (possibly of bone or wood), from the outside down onto the already flattened lip while the clay was fairly plastic. The two other rim sherds recovered in the Category C sample are both quite small. One of these may be a section of a shallow bowl. This specimen is incurvate and has a simple, unthickened, but flattened lip. This example has a cord marked exterior surface with oblique cord marking placed over horizontal cord marking. The rim interior is smoothed. The third rim sherd is simple and unthickened, has a rounded lip, cord marked exterior surface, and a smoothed interior.

Thickness: The sample ranges from 3.5 mm to 10 mm in thickness. In general, sherds of Category C are thinner than sherds of either Category A or B and individual sherd sections tend to be more uniform in thickness.

Vessel Size: Although a precise estimation of the vessel size cannot be made, the curvature of rim sherds and body sherds suggests that moderate sized vessels are represented.

Decoration: The only decorative technique employed was a single example of a tool impressed lip of a rim sherd.

Appendages: No appendages are present in the sample.

Other Remarks: One body sherd has an apparent crack lacing hole (Plate 39, D). The hole tapers from the exterior surface where it has a diameter of

10 mm to a maximum constriction of 3.5 mm about three-fourths of the way through the sherd and it expands to approximately 6 mm on the interior. It would appear that the hole is drilled both from the outside and the inside, with most of the drilling occurring from the outside toward the inside. It should be noted that this sherd has certain characteristics (thickness and flatness) that make it intermediate between the Category B and C samples.

The horizontal and vertical provenience of the Category C sherds is presented in Table 8. It is particularly interesting to note that the majority of the Category C ceramics (83%) occur in the southwest portion of Excavation A, and that very few examples (less than 1%) are found in Excavation B or in any of the outlying excavation units in Area 751. Furthermore, there is at least a suggestion, from the vertical provenience, that these sherds occur at a slightly higher elevation than do the Category A and B sherds.

TABLE 8: 140S347,
Area 751, Distribution of Category C Sherds

Number of Specimens	Horizontal Location (by X unit)	Vertical Location (elevation in feet)
17	Surface (6 of these are from X-107, an early test in the central dike)	
	Excavation A	
6	X-25	969.15 to 970.15
17	X-1	969.15 to 970.65
2	X-2	969.55 to 970.05
14	X-26	969.27 to 969.97
9	X-25	969.47 to 969.97
36	X-6	968.09 to 970.19
1	X-27	969.18 to 969.68
8	X-9	969.18 to 970.18
3	X-10	969.66 to 970.16
1	X-28	968.04 to 968.54

TABLE 8 (Continued)

Number of Specimens	Horizontal Location (by X unit)	Vertical Location (elevation in feet)
Excavation B		
1	X-31	969.15
Other		
1	X-191	968.47 to 968.97
1	X-192	969.33
<hr/> 117 Total		

Category D: Sample size 26. This category is something of a catch all. It includes a relatively small number of sherds which have identifiable temper (rounded sand, angular grit, and two shell tempered sherds) and exterior surfaces which are either smoothed or cord marked. Vessel shape could not be determined for sherds in this category.

Paste Characteristics

Temper: Twenty-four sherds (92%) are tempered with abundant particles of rounded sand and angular grit. Particle size is small, ranging from less than 1 mm to 2 mm in size. The remaining two sherds (8% of sample size) are sparsely tempered with finely crushed particles of shell. The particle size is less than 1 mm and the shell particles effloresce in muriatic acid.

Texture: The sand and grit tempered sherds in this sample have relatively coarse texture, particularly where the exterior surface has been partially eroded. The two small shell tempered sherds are more finely textured. The fracture pattern is uneven on all sherds.

Hardness: The sherds in this category range from 2 (gypsum) to 3 (calcite) on the Moh scale.

Color: Brown colored exterior surfaces predominate with a color range that includes very pale brown (Hue 10YR 7/4), pale brown (Hue 10YR 6/3), grayish brown (Hue 10YR 5/2), and dark grayish brown (Hue 10YR 4/2). Interior surfaces and cores exhibit the same range of color as the exterior. There is a tendency for the core coloration to be slightly darker than either the exterior or interior surfaces.

Method of Manufacture: There is no evidence for the method of manufacture in the sherd sample.

Surface Finish: Twenty-one of the sherds (81%) have smoothed exterior surfaces and five of the sherds (19%) have cord marked or partially smoothed over cord marked exterior surfaces. All interior surfaces are somewhat irregularly smoothed.

Form Characteristics

Vessel Shape: The small size of the sherds in Category D does not allow for an estimation of the vessel shape.

Rims: One of the two small shell tempered sherds appear to be a rim sherd. This example is a simple unthickened rim with a rounded lip.

Thickness: Nineteen of the sand and grit tempered body sherds range from 4 mm to 6 mm in thickness, five sand and grit tempered sherds range from 8 mm to 11 mm in thickness. The thickness could not be determined for the two shell tempered sherds.

Vessel Size: No data.

Decoration: No decoration appears on any of the recovered sherds in Category D.

Appendages: None were present.

It should be noted that the nineteen thin, sand and grit tempered sherds constitute a very uniform sample and are possibly all from the same vessel.

The horizontal and vertical provenience of the Category D ceramics is presented in Table 9. It will be noted that most of the Category D sherds cluster in the northwest portion of Excavation A.

TABLE 9: 140S347,
Area 751, Distribution of Category D Sherds

Number of Specimens	Horizontal Location (by X units)	Vertical Location (elevation in feet)
3	Surface	
	Excavation A	
1	X-3	969.60 to 970.10
8	X-27	968.18 to 969.68
1	X-9	968.68 to 969.18
8	X-28	968.64 to 969.64
1	X-13	968.47
1	X-17	968.67 to 969.17
	Excavation B	
1	X-19	- - - - -
1	X-31	968.70 to 969.30
	Other	
1	X-186	- - - - -
<hr/> 26 Total		

Miscellaneous Ceramics: As mentioned previously, 47 very small sherds were also recovered from Area 751 for which temper, vessel shape and surface finish cannot be determined.

Anomalous Ceramic Objects: Five additional ceramic objects were obtained from Area 751 at the Cow-Killer site for which specific functions cannot be determined (Plate 40, A-D). Three small ceramic objects all appear to be tempered, possibly with bone or shell, and they all have at least one surface that has been smoothed in a fashion very reminiscent of the smoothing on Category B sherds. However, the curvature of the pieces is not suggestive of any portion of a vessel section. In two cases the rather abrupt curvature of the surface opposite the smoothed surface is suggestive of very small ceramic containers,

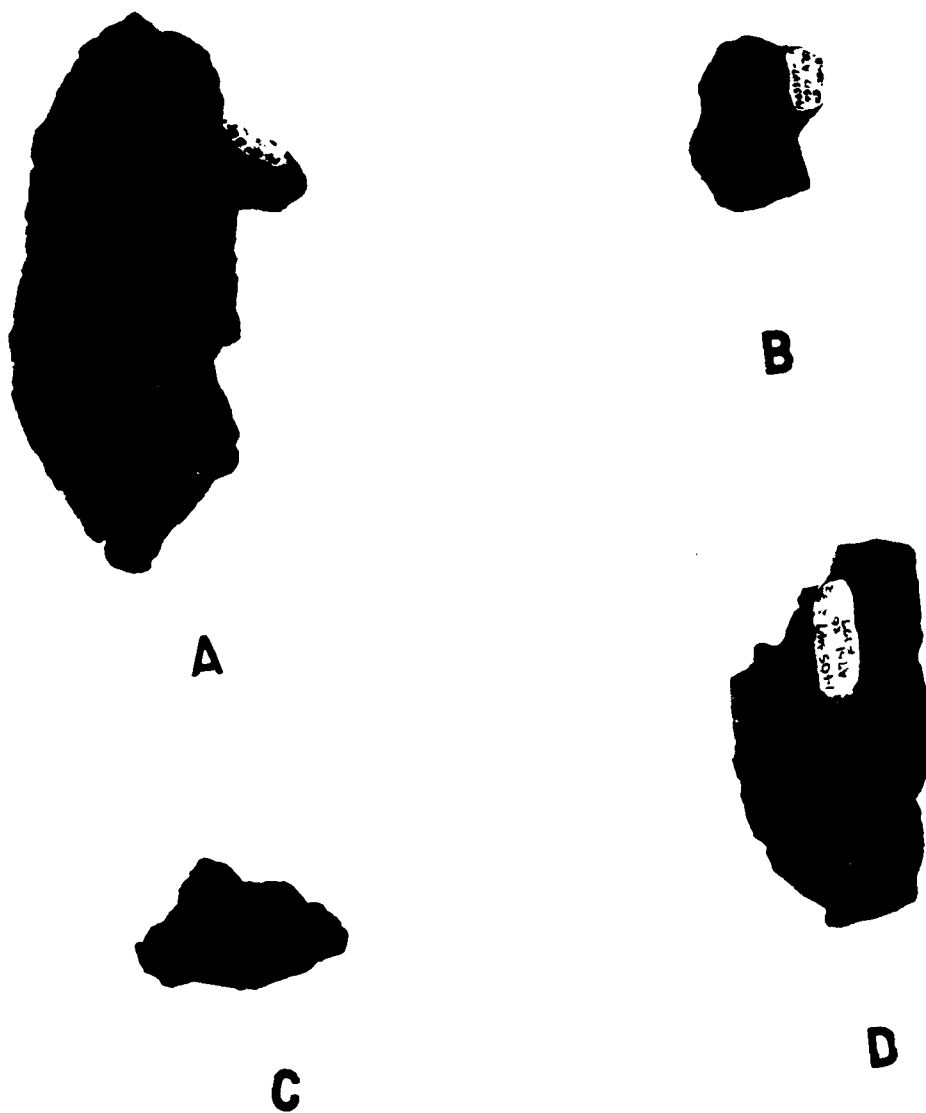


PLATE 40: 140S347, Area 751, Ceramic oddities

such as pipes (Plate 40, B). The third of these small pieces is puzzling because the smooth surface curves out and on the opposite surface, there are small grass impressions (Plate 40, C). As will be recounted in a later section, there were numerous examples of burned grass and pole impressed daub recovered from Area 751 at the Cow-Killer site, but this piece does not seem to equate with the crudely formed burned daub fragments. These three objects were recovered from X unit 1, X unit 3, and Feature 181, respectively, within Excavation A.

The fourth anomalous specimen was recovered from Feature 181, a trash complex located in X units 9 and 10 of Excavation A (Plate 40, A). This specimen is a lump of clay that is somewhat oval in cross-section and somewhat curved longitudinally. The specimen measures 90 mm in length, 39 mm wide, and 29 mm thick. This appears to be a lump of clay that was unintentionally fired. Its surface has been much checked and cracked, probably during the drying process, and some twig and grass impressions are visible on the exterior. The piece conforms well to the left hand and some possible finger impressions were noted on one face. I interpret this to be a piece of raw clay that had been shaped by a human hand and then inadvertently burned. Whether this represents raw potter's clay, raw clay to be plastered on a structure, or possibly for another function, is unknown. The piece does not contain any observable tempering additive. The amount of manipulation that the piece was subjected to in a raw state is obvious from the numerous folds and small increments of clay that are attached to it.

The fifth somewhat anomalous clay object was identified during the excavation of X unit 6 in Excavation A at an elevation of 968.35 ft and was assigned Feature 177 (Plate 40, D). This specimen of fired, but untempered clay has a maximum length of 64 mm, a width of 33 mm, and a thickness of 4 mm. It forms an arc perpendicular to the long axis suggesting that it was pressed against a pole. One end appears to be intentionally smoothed and the inner surface is somewhat smooth with three narrowly inscribed lines, each one being approximately 15 mm long. Two of these lines are parallel and the third crosses them at an oblique angle. Two small depressions are visible on the inner surface and the outer surface is quite irregular. The function of this object is unknown. It could be simply

a piece of fired daub that had been pressed against a pole, but the inscribed lines and the smoothing on one end suggest that it had some other function.

Ceramic Comparison

Ceramics recovered from Area 751 at the Cow-Killer site appear to be most closely allied to two previously defined ceramic types, Verdigris type and Greenwood type (Calabrese 1967, Wood 1977, Reynolds 1979, Witty et. al 1980). Verdigris and Greenwood types were originally described by Calabrese in a monograph entitled *The Archeology of the Upper Verdigris Watershed* (1967).

The Verdigris type was originally established on the basis of a collection of sherds, vessel sections, and one complete vessel recovered from the Curry site, 14GR301, in Greenwood county (Calabrese 1967:58-60). Calabrese noted this type was quite similar to a previously described type, Harlan Cord-Roughened, but that it was established as a separate type because of the presence of a different vessel form and different surface treatment (Calabrese 1967:60). Calabrese also noted a difference in predominant tempering additive for the two ceramic types. The Greenwood type was also established by Calabrese on the basis of the ceramic collection from the Curry site (1967:60-62). Calabrese noted that this type compared closely with Pomona ware from the Pomona reservoir area of eastern Kansas.

While the Cow-Killer ceramics appear to have their closest affinity to the Verdigris and Greenwood types, it is obvious that they also have similarities to other described ceramics of the Central Plains. Reynolds has noted a general similarity for Plains Woodland (Early Ceramic period) ceramic types and wares which includes Valley Cord-Roughened, Harlan Cord-Roughened, Grasshopper Falls ware and Verdigris type (Reynolds 1979). These similarities include overall vessel shape as well as vessel thickness and predominant surface treatment. In contrast, the Greenwood type seems more closely affiliated with ceramic types attributable to the Middle Ceramic period. As Calabrese notes, the Greenwood type is similar to Pomona ware of the Pomona focus. Pomona ware shares many similarities of vessel form, shape, and surface treatment with Central Plains tradition ceramic manifestations, such as the Riley Cord-Roughened type of the Smoky Hill aspect or phase (Wedel 1969:183-185).

In discussing the Verdigris type, Calabrese notes that sherds of this type have a medium coarse texture with an uneven fracture pattern (1967:58). Crushed limestone tempering

particles were noted in 90 percent of the sherd sample, with a particle size range from 5 mm to 7 mm. He further noted that the exterior and interior color of the sherds ranged from buff to browns and grays, with the majority being gray. Core color ranged from light gray to black (Calabrese 1967:58). The Verdigris type sherds ranged in hardness from 3 to 4 on the Moh scale. The typical exterior surface treatment was over all cord-roughening, applied vertically to the rims and at various angles on the vessel bodies. The cord-roughening on one large section was almost completely obliterated on most of the body of the vessel (Calabrese 1967:59). Thus, while cord-roughening was the more typical surface treatment, smoothed over cord-roughening and even complete smoothing was noted on some of the sherd sample. In terms of manufacture, Calabrese felt that the paddle and anvil method was probably utilized in producing the ceramics. The author disagrees with this interpretation, as an examination of the Verdigris type sherds from the Curry site reveals that the cord impressed surfaces lack evidence of having been slapped or paddled. It seems likely that the cord impressed surfaces resulted from the application of cord wrapped sticks or rods in a rolling pin fashion to the vessel surface. Calabrese noted an instance of interior striations, suggesting that they had been produced with a comb-like or grooved implement that could have been used for an anvil or as a finishing tool (Calabrese 1967:59). The vessel shape for the Verdigris type ceramic from the Curry site was determined by Calabrese to be basically conoidal base vessels with rounded to elongated bodies, poorly defined necks, straight rims, and flat to slightly rounded lips. The one complete vessel had a height of 21 cm, an orifice diameter of 12.3 cm, and a maximum diameter of 15 cm, occurring midway down the vessel wall (Calabrese 1967:59). A large, but incomplete vessel section was estimated to have a height of 27 cm to 37 cm, an orifice diameter of 27 cm to 30 cm, and a maximum diameter of 35 cm to 37 cm. Verdigris type sherds from the Curry site lacked any evidence of decoration or appendages. The Verdigris type accounted for 65 percent of the sherd sample recovered from the Curry site.

A visual comparison was made between the Verdigris type sherds from the Curry site and the ceramics recovered from Area 751 at the Cow-Killer site. Category A sherds from the Cow-Killer site are virtually identical to the Curry site sherds. They share similarities of overall vessel shape, sherd thickness, temper, and predominant surface finish. Category B sherds from the Cow-Killer site are similar to Verdigris type sherds in terms of overall vessel shape and sherd thickness, but they differ in tempering additive and predominant surface finish.

The Greenwood type, as described by Calabrese, differs considerably from the Verdigris type. Thirty-four percent of the sherd sample from the Curry site was assigned to the Greenwood type. The texture of the Greenwood sherds is fine to medium coarse and Calabrese notes that 53 percent of the sample sherds had cores that had a laminated or flaky appearance and that these sherds tended to fracture along these layers, while the remaining 47 percent had an uneven fracture pattern (Calabrese 1967:60). Ninety-five percent of the Greenwood sherd sample contained inclusions of round and angular particles of indurated clay that ranged in size from 0.5 mm to 2.5 mm in diameter. Tempering amounts ranged from sparse to abundant. Five percent of the sherds (representing one vessel) were shell tempered and two sherds were apparently tempered with small particles of gypsum. The exterior and interior surface color of the sherds ranged from buff to brown and gray with the majority being buff colored. Firing clouds were present on the interior and exterior surfaces of many sherds (Calabrese 1967:60). Core color ranged from buff to light gray to black and the sherds ranged from just above 2 to 4 on the Moh scale. Exterior surfaces were overall cord-roughened and this was usually applied vertically on the rims and parallel and crossed at various angles on the body sherds. Partial smoothing occurred on one rim and on most of the body sherds. The exterior surfaces of five sherds consisted of fine striations that were parallel and evenly spaced. No complete or restorable vessels were recovered, but Calabrese noted several characteristics of vessel shape and size. He suggested that these were medium sized vessels with globular-shaped bodies and rounded bases. Rims had flattened to rounded lips and the rim itself was either straight or curved. Rim heights ranged from 25 mm to 35 mm, with the average being about 30 mm. A slight neck was usually present, and the rim normally merged into a pronounced but smoothly curving shoulder (Calabrese 1967:61). Thickness of the sherds ranged from 3 mm to 9 mm with the average being about 6 mm. The only decoration occurring in the sherd sample occurred on one small rim. This consisted of incising on the lip made by a sharp object, such as a fingernail, and occurring at right angles to the exterior and interior walls of the sherd (Calabrese 1967:61). No appendages were present.

Comparison of the ceramic materials from the Cow-Killer site with those from the Curry site indicates that the Category C ceramics from the Cow-Killer site are quite similar to the Greenwood type sherds recovered from the Curry site. On the basis of a visual comparison of the two sherd collections, the author unhesitatingly places the Category C ceramics into the Greenwood type. The Category D ceramics from the Cow-Killer

site share certain characteristics, such as predominantly cord impressed surfaces, sherd thickness, etc., with the Greenwood type, but they exhibit different tempering material. Furthermore, the very small sample of Category D ceramics does not allow for a placement of this category into an existing type at this time.

In summary, both the Verdigris type and Greenwood types are represented in the ceramic sample from Area 751 at the Cow-Killer site. The attribution of the Category A sherds from the Cow-Killer site to the Verdigris type can be made with confidence, as can the attribution of the Category C ceramics to the Greenwood type. However, Category B ceramics present a problem since they exhibit different temper and different surface finish than that normally described for the Verdigris type. Provisionally, they will be considered part of the Verdigris type based on overall vessel shape and thickness. The author is not terribly comfortable with this attribution, but the establishment of a new ceramic type for the Category B sample does not seem warranted at this time because of the relatively small sample size obtained from Area 751. An interesting feature of the ceramic sample from the Cow-Killer site, and one noted at three other Greenwood phase sites (Two Dog site, Curry site, and Gilligan site) is the co-occurrence of a basically Plains Woodland ceramic type (Verdigris type) with a type that seems more closely aligned to the Middle Ceramic period (Greenwood type). The significance of this co-occurrence in terms of the chronological placement of the Greenwood phase and the cultural historical setting of this phase will be discussed in more detail in other sections of this report.

Chipped Stone:

While chipped stone tools and associated debitage were not found in great abundance in Area 751 at the Cow-Killer site, the recovered specimens are interesting and their analysis has allowed for an understanding of at least a portion of the technological and economic repertoire of the prehistoric inhabitants. Traditional artifact categories represented by the Cow-Killer chipped stone lithics in Area 751 include bifacial implements such as projectile points, drills, thin bifaces, and thick bifaces and unifacial implements such as sidescrapers and endscrapers as well as both utilized and modified flakes. Bifacial implements are also represented by both blanks and preforms and the general lithic inventory includes items that might be identified as burins. Flintknapping debitage recovered from Area 751 included cores, flakes and shatter.

Chipped Stone Debitage: As Crabtree and others have demonstrated, the technological processes for manufacturing finished artifacts, e.g., projectile points, bifaces, unifaces, etc., can only be understood by a careful study of the residue of the flintknapping process (1972). Such studies can also sometimes answer questions of more general interest, such as lithic source area or whether the stone modification was accomplished somewhere other than at the point of final deposition. As mentioned above, the flintknapping debitage recovered from Area 751 included cores, flakes and shatter. This debitage represents all stages of the silicate fracturing processes. Included are unmodified potential cores, cores, partially prepared bifaces and unifaces, primary decortication flakes, secondary decortication flakes, core reduction flakes, biface thinning flakes, internal thinning flakes, small thinning flakes, and shatter produced apparently both by percussion flaking and by either intentional or unintentional thermal alteration of the silicates.

The raw material for the chipped stone industry represented at the Cow-Killer site in Area 751 was apparently a locally procured river rolled chert which characteristically has an internal color ranging from gray to tan to olive and which has a smooth and hard, brown cortex. The gravel bars of the Marais des Cygnes river contain similar weathered chert cobbles and thus suggest a local origin for the resource. Certain foreign cherts are also represented in both the debitage categories and in the finished tools. Some of these silicates are quite similar to Permian cherts found in the Flint Hills Upland to the west of the Cow-Killer site and others appear to be identical, in the writer's opinion, to samples of white colored chert obtained from the Peoria chert quarries in extreme northeast Oklahoma. Still others cannot yet be identified as to source.

Thermal alteration of a portion of the lithic sample was noted both in debitage classes and artifact classes. Determination of thermal alteration was made on the basis of color (pink to red), glossiness, and slickness on freshly flaked surfaces. Occasional crazing and pot lid fracturing occurred both in the debitage classes and on the finished artifacts and is another characteristic of thermal alteration (Purdee 1975). Distinguishing between intentional thermal alteration (heat treatment) and unintentional thermal alteration cannot always be accomplished, although study of the frequency of thermally altered specimens occurring in artifact and debitage classes, and disproportionate amounts of pot lid and crazed debitage can give an indication of this.

In the following discussion, each of the major debitage classes represented in the Area 751 lithic inventory will be discussed. Included in these classes are unmodified potential

cores, test cores, multidirectional cores, primary decortication flakes, secondary decortication flakes, core reduction flakes, biface thinning flakes, internal thinning flakes, and both primary and secondary shatter.

Cores: Chert cores recovered from Area 751 at the Cow-Killer site included masses of material that range in size from large pebbles to fist sized cobbles and that contain negative flake scars that indicate the systematic detachment of flakes. The majority of identified cores from Area 751 are quite obviously of waterworn origin as they contain portions of the original hard, brown cortex or rind on their outer surfaces. The Area 751 core inventory can basically be divided into two classes, test cores and multidirectional cores. Test cores are specimens of waterworn cobbles which appear to have been tested for flaking quality by the removal of only a few flakes from one or more faces with the material subsequently discarded or otherwise abandoned. The second class of cores, multidirectional cores, show a more systematic preparation of the lateral edges of the cobbles for flake detachment. In addition, a number of potential cores, unworked waterworn chert cobbles, were encountered during the excavation of Area 751 and these presumably were brought to the site through cultural transportation rather than through natural agencies, as they were not noted to occur in culturally sterile areas of the Cow-Killer site. They are within the size range of actual cores, but they bear no evidence of modification.

A total of 16 test cores were recovered from Area 751. These are irregular-shaped nodules of river rolled chert which have a cortex that normally consists of a brown (Hue 7.5YR 6/4) to dark brown (Hue 7.5YR 4/4) external surface color. These nodules show evidence of minimal flake removals by a hammerstone. They appear to be tested cores which were either rejected, abandoned, or otherwise ignored subsequent to the initial flake removals. In some cases, the reason for rejection is obvious, as the negative flake scars reveal internal material which is flawed and obviously unsuitable for further reduction. The largest of these specimens measures 77 mm by 68 mm by 58 mm in size and the smallest measures 28 mm by 27 mm by 25 mm.

Thirty multidirectional cores were recovered from Area 751. All exhibit more than one negative flake scar and at least some cortex is still present on most of the cores, although one specimen is a secondary flake core and lacks cortex. That is, it is a large thick flake of irregular shape which has had additional smaller flakes struck from it. The cortex color on the multidirectional cores, when present, conforms to that of test or embryonic cores as described above. The size of the multidirectional cores range from 86 mm by 59 mm by 25 mm for the largest

to 30 mm by 23 mm by 23 mm for the smallest. One noteworthy observation is the absence of large cores in our inventory. Most of the recovered specimens appear to be virtually exhausted cores. Also noteworthy is the heterogenous nature of the cores. None appear to be cores prepared for blade or bladelet production. As we will note later, blades and bladelets (except for a few perhaps accidentally produced) are absent from the site inventory.

Shatter: Examples of lithic shatter recovered from Area 751 at the Cow-Killer site include cubical and irregularly shaped chunks of silicate, usually chert, that characteristically lack well defined bulbs of applied force such as is characteristic of either flakes or cores. Shatter commonly results from the application of hard hammer percussion techniques and the unintended cleavage of the silicate along internal fracture planes such as those produced by frost cracking and by too rapid heating or cooling of the silicates. Nonhuman agencies, such as frost cracking, can also produce shatter from silicates. Categories of shatter recovered from the Cow-Killer site include primary shatter, secondary shatter, and thermally altered shatter which exhibits pot lid fracture and crazing.

Ninety-two examples of primary shatter were recovered from Area 751 and at least six of these contained obvious evidence of thermal alteration. The primary shatter category includes irregular, angular-shaped specimens that have hard, brown cortex over their outer surfaces. They are similar to primary decortication flakes in that they evidently result from the primary reduction of chert river cobbles. However, they lack the characteristics of flakes (e.g., positive bulb of applied force, striking platform, concentric ripple scars, fissures, erailure, etc.) and they are typically blocky and angular fragments. In many cases, it is obvious that these fragments represent a very poor quality of raw materials which contain numerous flaws, and which fractured in an erratic manner rather than with conchoidal fracture. The largest of these specimens measures 61 mm by 37 mm by 17 mm and the specimens exhibit the same external surface and internal core color as the aforementioned cores from Area 751.

Two hundred forty-six examples of secondary shatter were recovered from Area 751 and it is evident that at least 16 of these were thermally altered. This large category of recovered materials includes irregular, angular-shaped specimens that typically lack any evidence of an external cortex. They are, in general, a result of core reduction but, either due to flawed raw material or imperfect flintknapping techniques, they lack the characteristics of flakes. Most of them are quite thick in relation to their length and width. They lack obvious striking platforms and bulbs of applied force. A number of them show either step or abrupt hinge

fractures, suggesting that they are a residue of core reduction by hard hammer percussion. They range in size from specimens of less than 1 cm in length to larger pieces, with the largest being 60 mm by 36 mm by 11 mm. It is the author's observation, based on his own flintknapping experience, that these pieces of shatter are a commonly occurring by-product of flintknapping, particularly when the raw material is of poor quality. In color and texture, these specimens are of the typical waterworn cobble derivation.

Flakes: One of the largest lithic categories recovered from Area 751 consisted of a variety of flakes produced by percussion and pressure flaking techniques. The relatively large number of flakes recovered from Area 751 makes this debitage class particularly important for what it can tell us about the flintknapping technology exhibited by these Plains Woodland peoples.

Primary decortication flakes are represented by 86 specimens recovered from Area 751. Primary decortication flakes are flakes that have been struck from the outside of chert cobbles or cores and which usually have a single striking platform and which contain cortex across at least 75 percent of the dorsal or outside face. In the specimens recovered from Area 751, the cortex normally consists of a brown (Hue 7.5YR 6/4) to dark brown (Hue 7.5YR 5/4), colored dorsal surface which contrasts with light gray, gray, pale brown, and pale olive interior chert color. The 86 primary decortication flakes are external flakes that have been removed from cobbles of river deposited or river rolled chert, such as occurs locally in gravel bars along the Marais des Cygnes river. The largest flake so classified measures 64 mm long by 42 mm wide by 18 mm thick and the smallest measures 13 mm long by 8 mm wide by 3 mm thick. Three of the primary decortication flakes (all apparently from the same core and all thermally altered) have a soft limey cortex which is fossiliferous. The internal color of the chert on these three specimens is a light yellowish brown (Hue 2.5YR 6/4) in color, with reddish brown (Hue 2.5YR 5/4) mottling. These are the only primary decortication flakes recovered that do not appear to be of the local river chert.

One hundred and eighty-two secondary decortication flakes were recovered from Area 751 and 18 of these have apparently been thermally altered. Secondary decortication flakes are flakes that have been removed from the outside of a core and which have cortex present on the dorsal surface, but covering less than 75 percent of this dorsal surface. The remaining portion of the dorsal surface has evidence of one or more previous flake detachments in the form of one or more negative bulbs of applied force. One hundred and eighty of the secondary decortication flakes recovered from Area 751 appear to be of local river chert origin. The two remaining examples are of a gray chert, possibly Permian in origin. The largest of the secondary decortication flakes recovered from Area 751 measures 80 mm by 55 mm by 26 mm thick and the smallest measures 9 mm long by 8 mm wide by 1 mm thick.

Two hundred and four flakes recovered from Area 751 have been classified as core reduction flakes or possibly uniface thinning flakes. Core reduction flakes are considered to be flakes which have a platform (often thick and wide) with an overhanging lip (Figure 13, A-D). The top of the platform typically lacks the faceting found on biface thinning flakes, although evidence of crushing or grinding is sometimes noted. The dorsal surface of the core reduction flakes typically has one or more negative flake scars evident upon it and it lacks cortex. The ventral face, i.e., the last surface attached to the core, exhibits a positive bulb of applied force, concentric ripple scars, fissures and often a visible single or multiple enlure. Flake termination can be step, hinge, feather, or snap and the lateral edges can be parallel, expanding, or converging. The two hundred and four core reduction flakes recovered from Area 751 have platform surfaces that are typically smooth and unmarred, although some show evidence of grinding or crushing. The platforms tend to be wide in relation to the axis of maximum width of the flake. Most specimens have an overhanging lip on the ventral face with a pronounced bulb of applied force on the ventral face at the proximal end. Some platforms are rather narrow. Some battering or crushing of the dorsal edge of the striking platform is evident, suggesting preparation of striking platforms prior to flake detachment. The dorsal flake scars are typically nonpatterned, suggesting that cores were subjected to little initial preparation. Thirty-one of the Area 751 core reduction flakes (15 percent of total) are thermally altered. The vast majority of the core reduction flakes, 199, are evidently of river cobble derivation, while four flakes are of gray chert believed to be derived from the Permian deposit in the Flint Hills and one flake (white in color) is similar to samples of Peoria chert from northeast Oklahoma. The size of the core reduction flakes is variable, but none are larger than 55 mm in overall length. These flakes tend to be relatively thin specimens and many are rectangular in shape.

A total of three hundred-sixty flakes recovered from Area 751 are classified as biface thinning flakes. Biface thinning flakes typically have a relatively small platform which contains the scars of previous flake detachments and/or is battered, crushed, or trimmed as a preliminary to flake detachment (Figure 14, A-G). Two varieties are recognized; those flakes with platforms and an overhanging lip (Figure 14, A-C), and those flakes with a platform but lacking the overhanging lip (Figure 14, D-G). The positive bulb of applied force on the ventral face is relatively diffuse as compared to that of a core reduction flake. Two hundred and eighteen

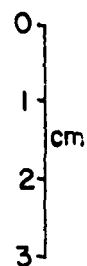
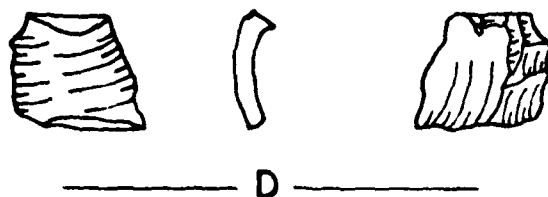
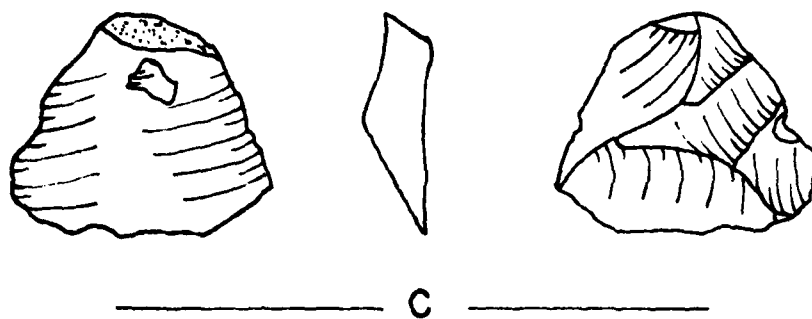
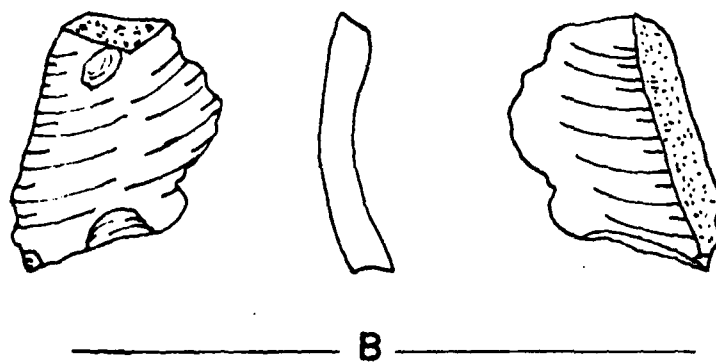
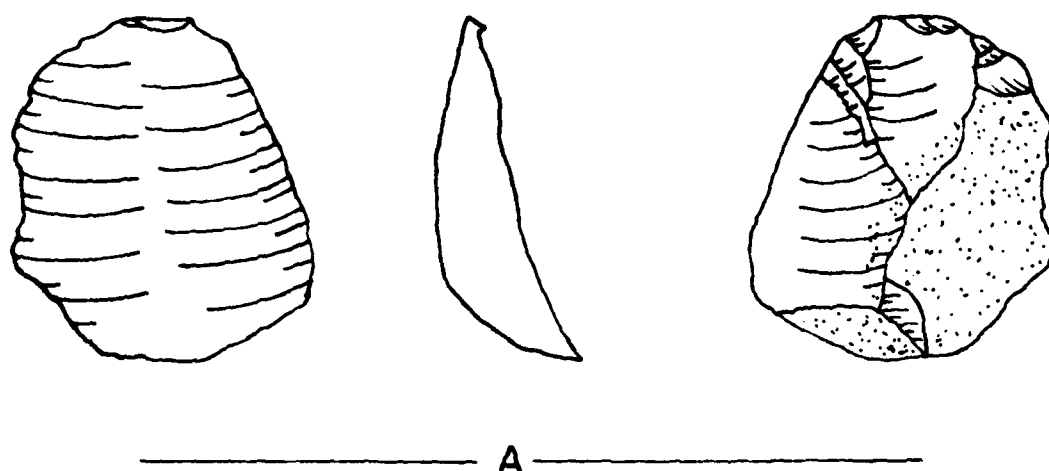


FIGURE 13: 140S347, Area 751, core reduction flakes

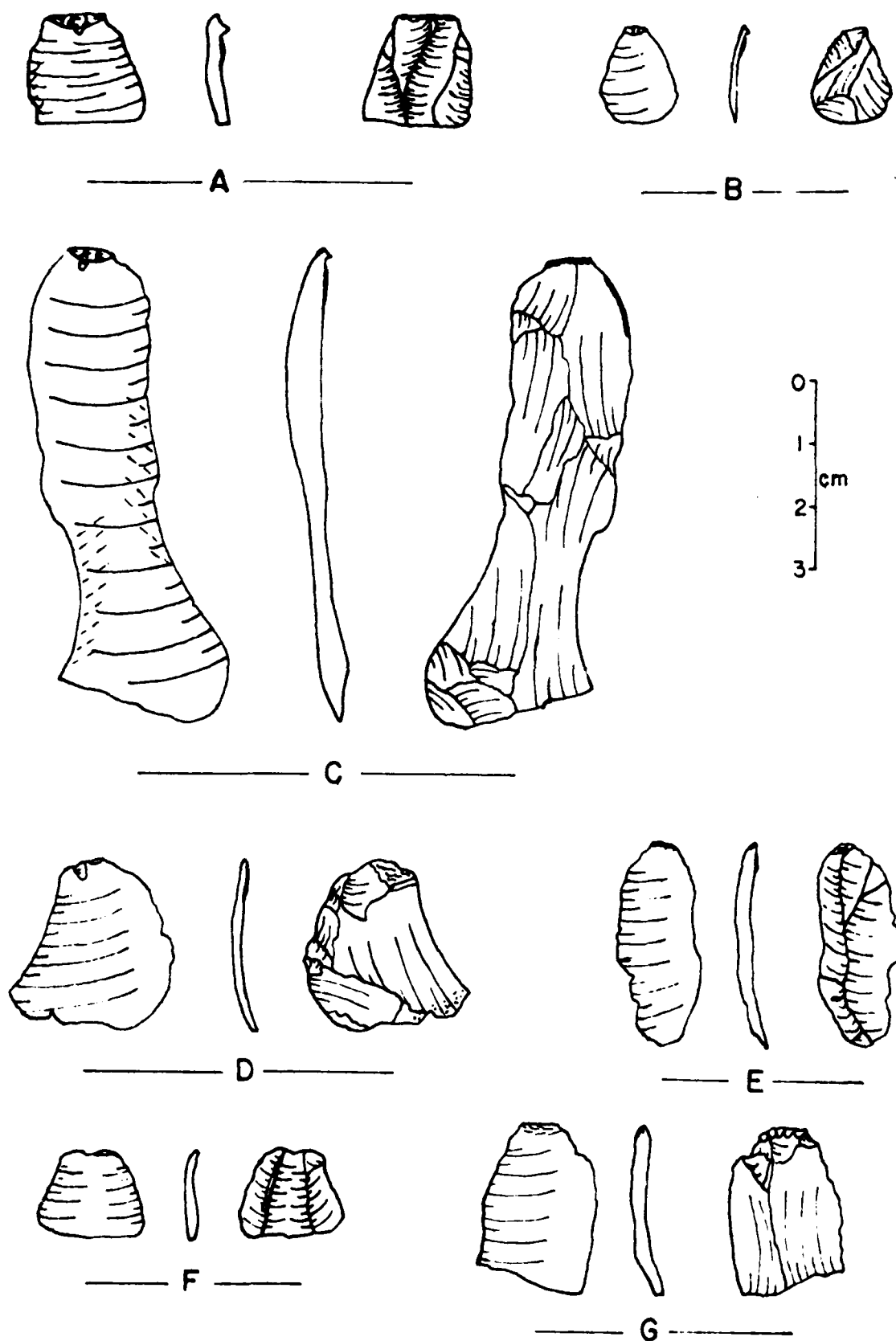


FIGURE 14: 14OS347, Area 751, biface thinning flakes

of the recovered biface thinning flakes from Area 751 exhibit a distinct platform and have an overhanging lip on the ventral face and 142 have at least a small remnant platform but lack the overhanging lip. The dorsal faces of the biface thinning flake typically exhibit nonpatterned flake scars from the previous flake detachments. The dorsal side of the platform usually exhibits minute flake scars (often steeply angled and very abrupt), or crushing, which has resulted from edge preparation prior to flake detachment. The ventral face has a pronounced to barely visible positive bulb of applied force. Concentric rings often visibly radiate from the platform area and fissures or hackles are sometimes visible, either toward the left or the right margin, or occasionally both. A small erailure is often visible on the bulb of applied force. The platform has pronounced to moderate lipping and usually has a multifaceted or occasionally crushed surface, which apparently results from edge preparation prior to flake detachment. The platform width ranges from very narrow to the full width of the flake, depending, apparently, on the tool used for flake detachment (e.g., hard hammer, soft hammer, impulsive pressure, etc.). These flakes range from expanding to parallel sided to converging and all categories of termination (feather, hinged, step and snap) occur.

While the aforementioned flakes have been classified as bifacial thinning flakes, and the author believes that such flakes were typically produced by bifacial thinning, he is nevertheless aware that similar flakes can be produced both when reducing a core and when working the dorsal face of a uniface if the core or uniface edge has been sufficiently prepared by abrasion, crushing, or step flaking. At least four characteristics are considered important in classifying these flakes as bifacial thinning flakes. First of all, these flakes typically have a multifaceted platform on both the ventral and dorsal surfaces. Secondly, they are relatively thin flakes. Thirdly, they typically have either parallel or expanding edges and are only rarely converging. The fourth observation is that they most often terminate in feathering at the distal end. Furthermore, core reduction flakes and uniface thinning flakes tend to have a different angle of platform to flake length than biface thinning flakes. That is, core reduction flakes and uniface thinning flakes typically have a platform that is more at a right angle to the flake length than the obtuse angle noted on biface thinning flakes. Also, core reduction and uniface thinning flakes tend to have single faceted or unfaceted platforms. But, as noted, edge abrasion, particularly edge abrasion perpendicular to the edge axis, can create facets on core reduction flakes and uniface thinning flakes that can be mistaken for biface platform facets.

The pronounced lips that are present on the platform of some biface thinning flakes evidently reflect either direct or indirect percussion with either a hard hammer (stone) or a baton or a punch (antler, bone, hardwood). The author has been unable to experimentally produce biface thinning flakes by impulsive pressure which have this pronounced lip although they are of common occurrence when batons or hammers are employed in biface thinning. Those biface thinning flakes which lack the pronounced lip, in the author's opinion, could be prepared either by a hammer technique or by impulsive pressure. The reason that bifacial thinning flakes typically show facets on both the dorsal and ventral platform surfaces is evidently because of the relatively thin and lenticular cross-section of the edge of bifaces, as opposed to core and uniface edges which have angles which are more obtuse. That is, the platform being abraded or otherwise prepared on a biface is more fragile than on an obtuse edged uniface or core edge. Very occasionally, biface thinning flakes will have a small amount of cortex present on the distal end of the dorsal face.

Twenty-five of the biface thinning flakes from Area 751 are of a gray color, suggestive of the Permian cherts of the Flint Hills Upland and two are white in color. The remainder are of the typical river cobble derivation. The largest of the biface thinning flakes recovered from Area 751 measures 75 mm long by 25 mm wide by 5 mm thick. This particular specimen could be considered a blade, based on its length to width ratio, although the author believes that it is simply an anomaly and not an intentionally prepared blade. This belief is supported by the nonpatterned flake scars on the dorsal surface which do not exhibit the careful core preparation typical of blade removal. The smallest flakes classified as biface thinning flakes are less than 10 mm long and wide and quite thin.

Four hundred sixty flakes from Area 751 were classified as internal thinning flakes or interior flakes. These flakes typically lack any evidence of a platform and they are produced by the breaking up of larger flakes during the process of flake removal from a core or from a biface. They are often produced by internal stresses which create recurrent step fractures on a flake during production and which separate that flake into two or more components, only one of which is likely to contain a platform. They can also result from snap fracture occurring after production by accident or misadventure. The origin of these flakes can be either from core reduction flakes or biface thinning flakes as well as uniface thinning flakes. Of the 460 recovered internal thinning flakes, 30 are of a gray color suggestive of the Permian cherts to the west

of Melvern lake and four are of the white color suggestive of the Peoria cherts of northeast Oklahoma. The remainder of the flakes appear to be of local river cobble derivation and a number of them exhibit thermal alteration. The largest flake in this category measures 34 mm long by 32 mm wide by 4 mm thick and the smallest is less than 10 mm long and wide and correspondingly thin.

An additional 100 plus very small biface thinning, core reduction, and internal thinning flakes were recovered from Area 751. These flakes were not subjected to hand lens identification or binocular microscope identification which allowed for the placement of the other flakes into the aforementioned categories.

Thermally altered shatter which exhibits pot lid fracture or crazing: the archeological literature contains numerous references to thermal alteration of silicious materials both in an archeological and experimental context (Crabtree and Butler 1964, Mandeville 1973, Mandeville and Flenniken 1974, Shippee 1963, etc.). That intentional heat treatment was a technological process associated with flintknapping in the prehistoric world is an established fact. One difficulty that arises in analyzing the chipped stone material from Area 751 at the Cow-Killer site is in determining whether or not thermal alteration was regularly practiced by the Plains Woodland inhabitants.

Evidence for thermal alteration of silicates normally consists of change in color (tendency for change from gray, tan, green, etc. to a weak red), change in luster (while heat-treated surfaces are initially dull, subsequent flake scar removals reveal glossy or vitreous surfaces), and improved workability of the stone which can be recognized by longer, thinner flakes and flake scars. These evidences will be manifested both on artifacts and on lithic debitage. Few, if any, of the artifacts from Area 751 contain such evidence. However, fairly large numbers of flakes and shatter specimens contain evidence of thermal alteration. A close inspection of these specimens suggests that most of these are the result of unintentional thermal alteration, rather than intentional heat treatment. The present category of shatter which exhibits pot lid fracture and crazing were separated from the other shatter categories because they seem to provide particularly good examples of unintentional thermal alteration. These specimens exhibit the typical reddish coloration which is suggestive of thermal alteration. These 77 pieces of shatter from Area 751 also exhibit characteristics that Purdee (1975) has attributed to unintentional or accidental thermal alteration. The most common type of erratic fracture occurring on these flakes was

pot lid fracture. Crenated fracture, resulting from rapid cooling, was not noted in the sample but crazing may have been present on a few specimens. Purdee notes that pot lid fracture and angular, blocky flakes with no bulb of applied force commonly result during the heating process when lithic materials are accidentally, or through miscalculation, elevated in temperature too rapidly (1975:136). A high incidence of angular, blocky flakes which lacked bulbs of applied force was noted in this sample.

Crenated fracture, in which one or more fracture edges exhibit rounded scallops, can occur when heated stone is either too rapidly cooled or when such materials are allowed to cool too rapidly and subsequently flaked (Purdee 1975:136-137). Crazing (shrinkage cracks) occurs when samples are heated to too high a temperature. All of these fracture patterns are quite distinct from the typical conchoidal fracture which occurs through normal percussion and pressure flaking techniques.

As noted above, the other lithic debitage from Area 751 contains scanty evidence for intentional heat treatment. Using color and luster as a guide, it appears that no more than 12 percent of the biface thinning flakes with a pronounced platform and lip were heat altered. Twenty-two percent of the biface thinning flakes which lacked the pronounced platform may have been heat altered. Similarly, of the 59 chert tools or tool sections recovered from Area 751 (excluding utilized/modified flakes), only 11 (or 18%) suggest that thermal alteration occurred. For both flakes and tools we cannot, at this time, establish whether any of this thermal alteration was intentional. Some of it almost certainly occurred accidentally and the author suspects that most, if not all, of heat altered specimens at Area 751 are a result of accidental firing rather than a result of intentional heat treatment. This is perhaps most dramatically shown in the case of the one specimen of a drill that was recovered from Area 751. Archeological specimen number 2685 (Feature 259) consists of the base and a portion of the midsection of a T-based drill. Specimen 2684 (Feature 178) consists of a portion of the midsection of the same drill. The two specimens were encountered less than 30 cm apart and at the same elevation. They were separately featured to record their exact proveniences. The first specimen, number 2685, is made from a chert which is light yellowish brown (Hue 2.5Y 6/4) in color. The second specimen, which fits exactly onto the first, is reddish brown (Hue 2.5YR 4/4) in color. It is clear that the drill broke and the second section (toward the tip) became thermally altered, presumably accidentally. The lack of glossiness on the heat altered specimen indicates that it was not subsequently flaked. Interestingly, the heat altered section does not bear evidence of the kinds of fracture (pot lid, crenated or crazed), which commonly occurs through

improper or accidental heating or cooling. As Purdee (1975) notes, however, these fractures occur with less frequency on small specimens than on large ones.

Chipped Stone Tools:

Traditional functional categories for chipped stone tools will be observed in the following description of the Area 751 chipped stone tools. The author recognizes the limitations imposed by this traditional classification, but the utilization of it will make future comparisons easier.

Projectile Points: Projectile points are herein considered to be thin, bifacially flaked tools with a distal point and a proximal hafting element. While these are traditionally termed projectile points, they could have been multipurpose tools. A total of 11 projectile points or sections of projectile points were recovered from Area 751 (Figure 15). Ten of the specimens were recovered in situ in undisturbed cultural deposits. The eleventh specimen was recovered from the surface of the disturbed construction cut prior to archeological excavation. These 11 specimens include a single lanceolate point, three large stemmed projectile points, three small corner notched projectile points, a base of a plain triangular point, and three additional point midsections of relatively small points.

The single lanceolate point from Area 751 was recovered from excavation unit 24 and was designated as Feature 273 (Figure 15, A). This specimen measures 99 mm by 24 mm wide by 7 mm thick and is quite well made. The edges are slightly excurvate and terminate in a very sharp point. The lateral edges taper slightly at the distal end to create a barely perceptible contracting stem or hafting element. The specimen is lenticular in cross-section and the two faces exhibit nonpatterned flake scars, although there is a tendency to oblique flaking. The lateral edges show discontinuous pressure retouch on portions of both faces. The material from which this specimen is made is a gray chert (Hue 10YR 6/1).

Three medium sized to large stemmed projectile points were recovered from Area 751. The first of these specimens is a large and well made corner notched projectile point (Figure 15, C). This specimen was catalogued as Feature 109. It measures 85 mm long by 36 mm wide by 6 mm thick and the stem element comprises 16 mm in length. The specimen is made from a light yellowish brown chert (Hue 2.5Y 6/4). The blade outline is triangular and the specimen is flat to lenticular in cross-section. It exhibits nonpatterned flake scars on both faces and discontinuous marginal pressure retouch on the lateral edges. The stem is expanding with a straight base and the specimen has pronounced and dependent barbs. The specimen appears to be made from the typical river cobble chert available in the local area.

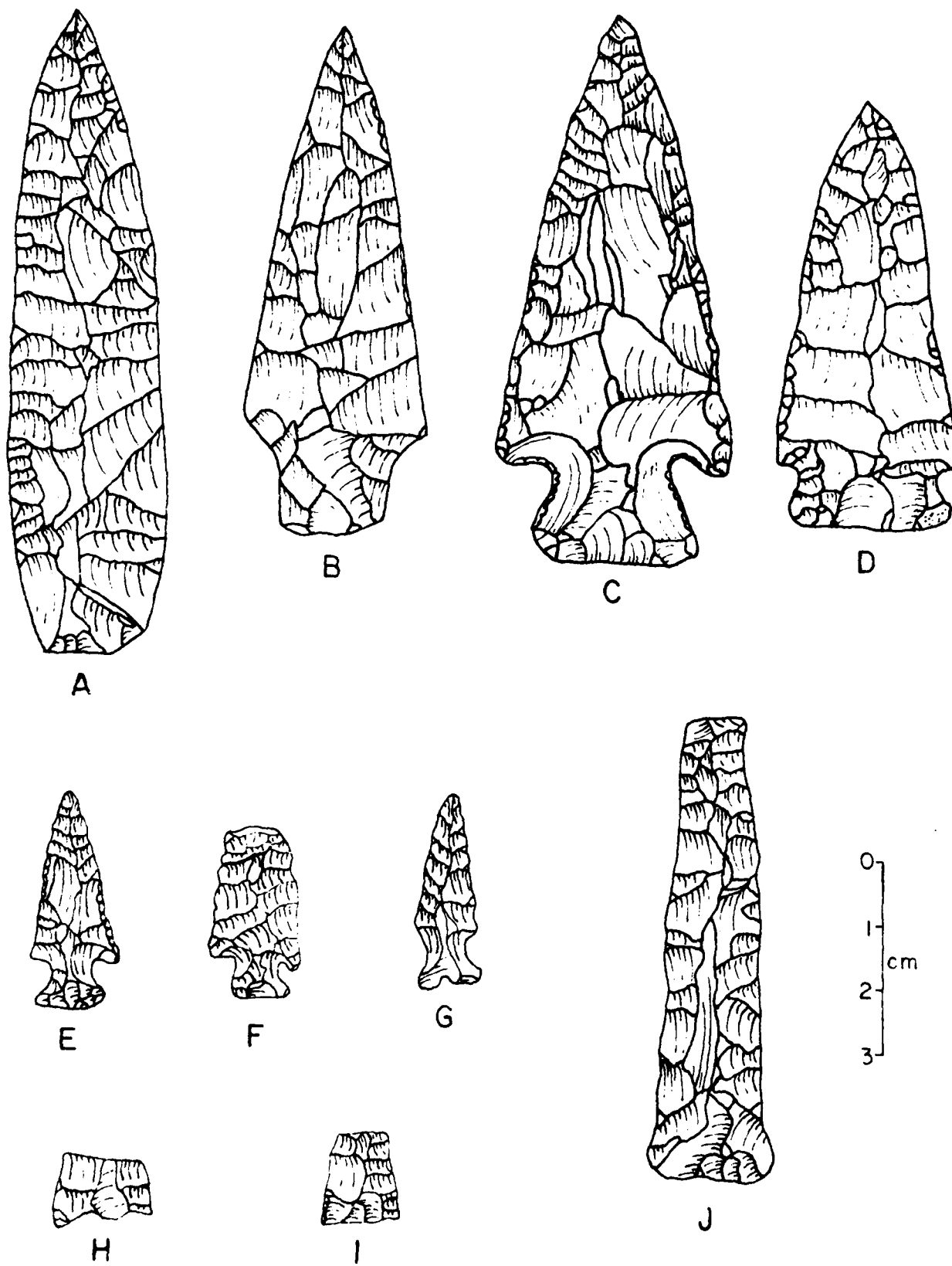


FIGURE 15: 14OS347, Area 751, projectile points and a drill

The second corner notched projectile point measures 66 mm long by 27 mm wide by 5 mm thick and is flat to lenticular in cross-section (Figure 15, D). The hafting element on this specimen measures 11 mm. The blade outline is roughly triangular, but the proximal end angles in abruptly, suggesting minor resharpener. The flaking on both faces is either nonpatterned or possibly weakly collaterally flaked. The stem element exhibits shallow corner notches, straight barbs, an expanding stem, and a convex base. This specimen is made from a white chert (Hue 10YR 8/2) which is suggestive of the white chert from the Peoria chert quarries in northeast Oklahoma.

The third large stemmed projectile point was designated as Feature 244 and came from excavation unit 10 (Figure 15, B). This specimen measures 78 mm long by 28 mm wide by 7 mm thick and the stem element is 16 mm long. The specimen has a triangular blade shape with straight lateral edges and it is lenticular in cross-section. Nonpatterned flaking was observed on both faces. The specimen has a contracting stem with a convex base. It is made from a light yellowish brown chert (Hue 10YR 6/4), that is very soft, grainy, and coarse and it contains numerous very small, white fossil inclusions. The author judges the workmanship on this specimen to be of excellent quality, since the material is obviously very coarse in nature and very soft.

The three nearly complete small corner notched projectile points that were recovered from Area 751 are all typologically similar to the Scallorn point type as defined by Bell (1958). The first of these is designated as Feature 195 (Figure 15, E). This specimen is 33 mm long by 13 mm wide at the maximum width, by 4 mm thick and the stem is 8 mm long. This specimen has a triangular blade with rough serrations and the specimen is lenticular in cross-section and has nonpatterned flaking on both faces. This point is dark gray in color (Hue 7.5YR N4/). This does not seem to be of a local river cobble chert. The stem exhibits straight barbs, expanding lateral edges of the stem, and a straight base.

The second small corner notched projectile point exhibits the same basic outline as the previously described small, corner notched point except that it lacks the tip (Figure 15, G). This latter specimen was found in the construction cut for the sewer lagoons. It is made of a light yellowish brown chert (Hue 10YR 6/4), and it measures 29 mm long by 8 mm wide by 5 mm thick and has an 8 mm long stem element. This specimen is thus rather thick relative to its width. It is also a very small specimen with shallow corner notches that produce an expanding stem. The base is slightly concave.

A single specimen of an apparent plain, triangular projectile point, designated as Feature 166 and found in X unit 5, was recovered from Area 751 (Figure 15, I). This specimen is missing the upper half.

It is made from a reddish brown chert (Hue 5YR 5/3) and it measures 11 mm wide at the base, 3 mm thick, and had an estimated original length of 24 mm. The blade outline is triangular with a straight base.

Three additional projectile point fragments were recovered in Area 751 (Figure 15, H). Two of these appear to be small possibly plain, triangular or corner notched projectile points and a third appears to be the tip section of a somewhat larger medium sized projectile point. All seem to be made out of the local derived river gravels and all are so incomplete that measurements cannot be taken.

Drill: A single chipped stone drill was recovered from Area 751 (Figure 15, J). This specimen consists of the base and midsection of a T-shaped drill. The drill was recovered in two sections in X unit 9 of Excavation A in Area 751 and separate feature numbers were designated to the two specimens. The two specimens were located less than 30 cm apart and at the same vertical location, but their relationship was not immediately recognized because one of the sections had been thermally altered and was a different color than the other. The base section, which was not thermally altered, occurred as an isolated find while the altered midsection was discovered just west of a trash complex, Feature 181, which contained potsherds, burned limestone, sandstone and a bone fragment. Also noted in the area of the midsection were small amounts of burned earth and charcoal. The extant portion of this drill measures 71 mm in length and the specimen probably had an overall length no greater than 85 mm. It has a base width of 20 mm, tapers to 9 mm at the proximal or tip end, and is 8 mm thick. It is biconvex in transverse section and was apparently produced with a combination of percussion and pressure flintknapping techniques. A slight amount of dulling was noted on both lateral edges immediately above the expanding base element and this suggests preparation for hafting. The lateral proximal edges, and in fact both faces, show considerable dulling and rounding, as is common to chipped stone drills which have been utilized to drill fairly hard materials.

As noted previously, the most unique aspect of this specimen is the obvious evidence of unintentional thermal alteration which is revealed by the midsection. The unaltered base is made from a chert of light yellowish brown color (Hue 2.5Y 6/4) while the midsection, which fits exactly onto the base, is reddish brown (Hue 2.5YR 4/4) in color. It is obvious that the drill was broken and that the midsection was later thermally altered, presumably accidentally. The dull finish of the thermally altered midsection indicates that no further modification of this specimen took place.

Spokeshave: One of the more interesting chipped stone tools is a small, thick, disc-shaped biface which has two notches set opposite

each other on the lateral edges (Figure 17, B). This specimen, Feature 260, was recovered from the fill of a shallow, trash-filled basin, Feature 248. The specimen measures 49 mm in diameter and is 15 mm thick at its thickest part. The object is plano convex in cross-section and exhibits nonpatterned flake scars on both faces and discontinuous pressure retouch on portions of the lateral edges of the dorsal face. The two opposing notches are 3 mm to 4 mm deep and 9 mm wide and are semicircular when viewed from either the dorsal or ventral face. Some edge blunting and crushing can be observed at intervals all around the margin of this specimen. Portions of the lateral edges exhibit occasional polished areas which extend approximately 3 mm up onto either or both dorsal and ventral faces. The opposing notches are much polished and blunted. This tool is interpreted to be a cutting or scraping tool for either woodworking or bone working. The high degree of blunting and polishing of the two notches suggests that the main function of the tool was as a spokeshave. This specimen is made from river cobble chert and is pale brown (Hue 10YR 6/3) in color and has small white inclusions.

Thin Bifaces: Twelve thin bifaces were recovered from Area 751 which are complete enough to merit separate discussion (Figure 16, A-J). Eight of these are complete or nearly complete specimens and the remaining four are base or tip sections. The largest complete specimen is 68 mm long, 31 mm wide, and 12 mm thick and the smallest complete specimen is 38 mm long, 20 mm wide, and 5 mm thick. In shape they range from triangular to ovate to ovate acuminate. While these forms are typically categorized as knives in the archeological literature, they may actually represent projectile point preforms and crude projectile points as well as knives. Eleven of these thin bifaces were recovered during the excavation of Area 751 and one was found on the disturbed surface of the grader cut. Nine of the bifaces were accorded features status and their exact provenience, both horizontally and vertically, is known. The remaining two excavated bifaces are referenced by half foot level within X units. The classification of bifaces into the category of thin bifaces was made on the basis of a simple arithmetical computation. Any bifaces which had a length to thickness ratio of 5/1 (.20) or less, were so classified. The relatively complete bifaces in this category have length/thickness ratios ranging from .10 to .19. Bifaces which exhibited a length/thickness ratio greater than 5/1 (i.e., $> .20$) were classified as thick bifaces.

Seven of the thin bifaces appear to be made from the typical river chert found so abundantly at the Cow-Killer site. Two other specimens show evidence of possible thermal alteration and one of them exhibits a distinct reddish brown color (Hue 5YR 5/4). The two remaining specimens are made from a gray chert similar to the Permian cherts of the Flint Hills to the west. One ovate specimen

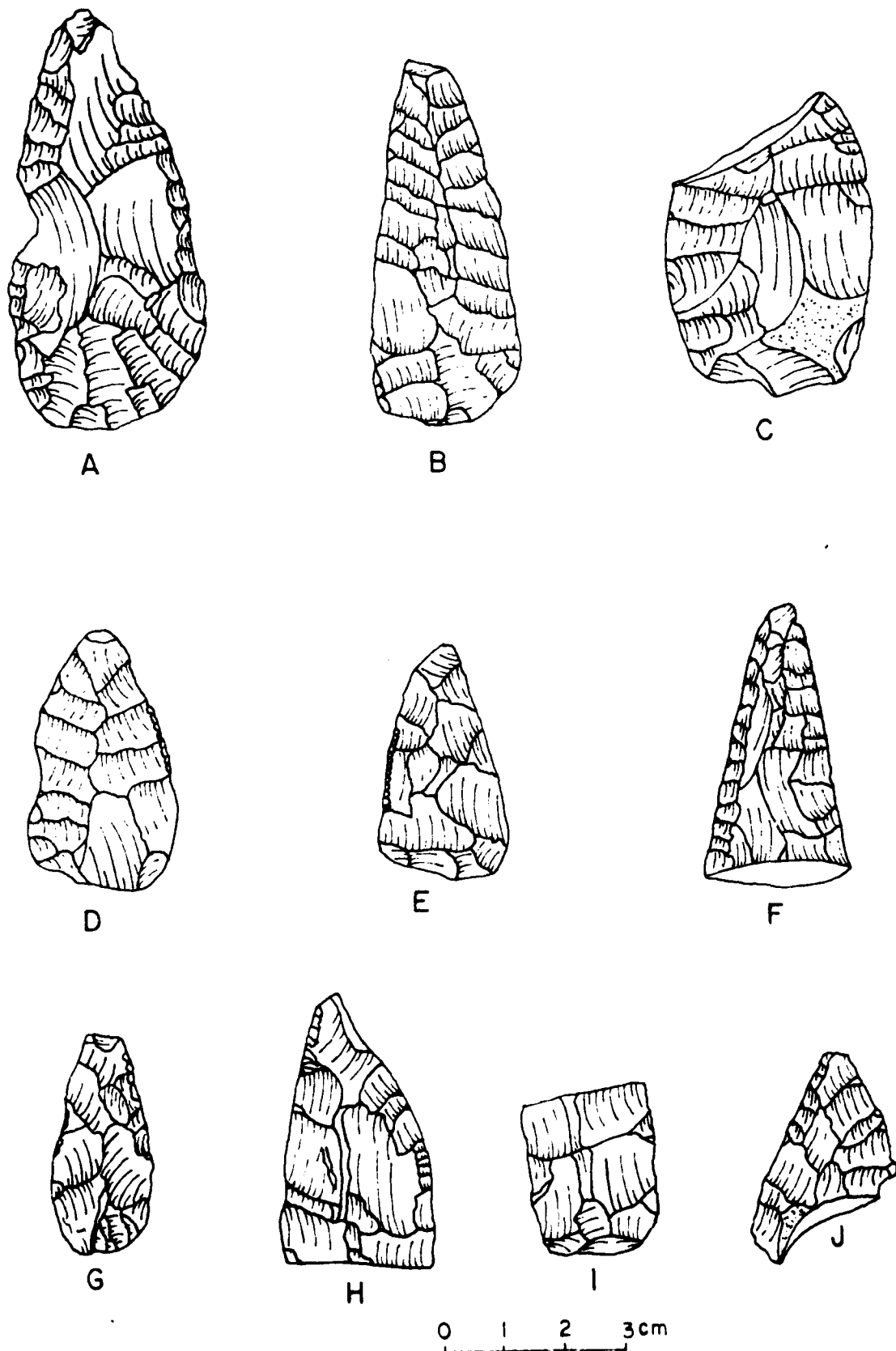


FIGURE 16: 140S347, Area 751, thin bifaces

was produced on a cortical flake (Figure 16, C). This specimen has a weathered brown cortex over approximately one-third of its dorsal surface. Bifacial thinning flakes are evident on both ventral and dorsal surfaces of all twelve of the thin bifaces. The workmanship ranges from crude to quite careful and several of the thin bifaces exhibit secondary pressure retouch along one or more lateral edges and often on both faces. The bifacial thinning is basically nonpatterned with at least some of the flake scars terminating in hinge fracture on virtually every piece. Moderate and discontinuous bifacial edge wear is visible on a number of the specimens. However, edge abrasion, as preparation for bifacial flaking, produces edge wear that is quite similar to that produced by tool use. The author could not determine whether the edge wear evident on the thin bifaces was a result of bifacial thinning preparation or tool use. Lack of crushed and battered edges suggest that these relatively thin implements were not used in a chopping manner and that if they were indeed functional tools, that they were probably used in either a cutting or scraping manner.

Thick Bifaces: A total of nine complete or relatively complete thick bifaces were recovered from Area 751. One of these (Figure 17, B) is a special purpose tool, a spokeshave, and it has been described in another section of this report. The remaining specimens include one chipped celt and seven cruder bifaces (Figure 17, A, C-I). Nearly complete specimens, for which measurements could be obtained, had length/thickness ratios which ranged from .25 to .34. This length/thickness ratio clearly separates these specimens from the thin biface category which had a length/thickness ratio of 5/1 (i.e., .20) or less. One specimen is made from a gray colored chert (Hue 2.5Y N5/) of possible Flint Hills derivation. The remaining seven specimens, including the celt, appear to be made from the locally available river cobble chert and exhibit the expected color range. No definite evidence of thermal alteration was noted on any of the specimens, although the celt has a small reddish area on the bit end that could be a result of heating. Six of the crude thick bifaces were recovered during excavation. All of these were either located within structural features (i.e., pits, basins) or were accorded individual feature status. The celt and one crude thick biface were recovered from the disturbed surface of the stabilization pond area.

The recovered celt measures 72 mm long, 41 mm wide at the bit, and 18 mm thick (Figure 17, A). The specimen is somewhat triangular in shape with one straight lateral edge and one slightly convex. The bit or proximal end is convex and the distal end is somewhat flattened. The dorsal face of this specimen (as illustrated in Figure 17, A) exhibits all over, nonpatterned percussion flakes which are directed into the prominent dorsal keel from the lateral

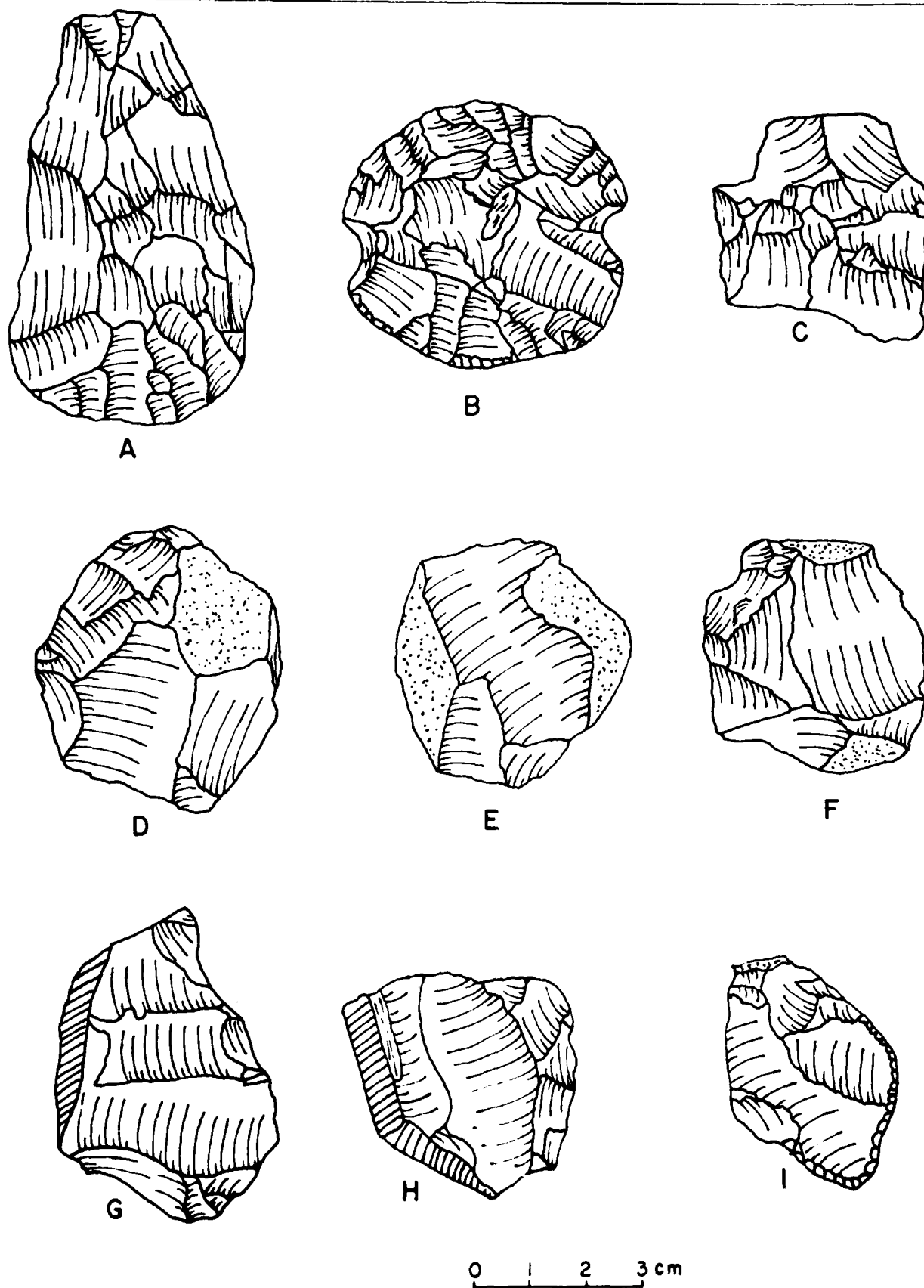


FIGURE 17: 140S347, Area 751, thick bifaces

edges. A number of these flake scars terminate in hinge fractures. The ventral face of the celt is covered over approximately one-half of its surface with similar biface thinning flake scars. The lateral and bit edges of the specimen are relatively straight and are oriented toward the ventral face. That is, the edges of the specimen are not located in the center of the celt when it is viewed from the lateral sides or from the ends. Smaller and more regular flake scars, and some moderate crushing, were observable on the dorsal face of the bit end, suggesting both shaping and utilization. Inferentially, this object was a small chopping tool. Some abrasion (probably grinding) was noted on the lateral edges toward the tapering distal end and this suggests that the celt may have been hafted.

The seven remaining thick bifaces are much more crudely made than the celt (Figure 17, C-I). Typically, they have four or more percussion flake scars on each face and sinuous edges. Two specimens have cortex on their dorsal surfaces and two others have cortex present on their distal ends. They are all irregular in shape and, in general, represent the first stage of biface preparation. Two specimens (Figure 17, G and H), both from X unit 19 in Excavation B, once fit together into a broad biface (72 mm wide and 15 mm thick, length is indeterminant) but they presently exhibit flake scars along the line of juncture that suggest subsequent modification following breakage. One other specimen (Figure 17, I) exhibits fine pressure retouch along portions of its lateral edges on the ventral face. The subrectangular, ovate and irregular-shaped bifaces average 45 mm in diameter and 15 mm in thickness. With the exception of the specimen with the pressure flaked edge, no obvious wear patterns were observed.

Biface Sections: In addition to the previously described thin and thick bifaces recovered from Area 751, 16 biface fragments were recovered which are too incomplete to allow for more specific classification. These consist of portions of tip, middle and base sections of small to medium sized thin and thick bifaces. Some thin and carefully flaked specimens may be sections of projectile points while others are clearly sections of larger, thicker tools. Lateral snap was observed on some of these specimens, suggesting that they were preforms which were broken during the actual manufacturing process. Two of the specimens are made of a gray colored chert while the remainder were evidently produced from local river cobble chert. Two, or possibly three, specimens have a color which suggests thermal alteration.

Uniface Scrapers: The descriptive category of uniface scrapers includes those unifacially flaked chipped stone implements which possess at least one working edge which typically exhibits steeply angled flake scars, on the dorsal flake surface usually, which do

not carry very far toward the midline of the object. Endsrapers characteristically have this flaking present on the proximal, or more rarely, on the distal end of the flake. Sidescrapers, as is implied by the name, have one or both lateral edges similarly modified. Caution must be observed when using terms like "scraper". Many artifacts classified as scrapers have certainly functioned as multipurpose tools. The author's own experiments have convinced him that many "sidescrapers" function equally well as knives for cutting both soft and hard materials. Some of the wear patterns produced on experimentally produced scrapers, which have been used as multipurpose tools, duplicate edge wear on prehistoric specimens from the Historical Society collections.

Five endscrapers were recovered from Area 751 at the Cow-Killer site (Figure 18, A-E). Only one of these (Figure 18, A) approaches the well made plano-convex endscrapers that are typically encountered on prehistoric sites in Kansas, although all these specimens are well within the range of such implements. This specimen (Figure 18, A) was apparently produced with a combination of pressure and percussion techniques, and the flaking on the dorsal surface is quite regular. The proximal end of this specimen is missing and apparently this resulted from unintentional burning. The specimen is weak red (Hue 10YR 5/3) in color and the broken surface exhibits both glossiness and numerous pot lid fractures. This specimen is 34 mm wide and 13 mm thick. Length could not be determined. This example was recovered from the stabilization pond construction cut, so provenience is uncertain.

The remaining endscrapers are all smaller specimens. Two complete examples measure 37 mm long, 23 mm wide, 8 mm thick and 31 mm long, 22 mm wide and 5 mm thick. Three of these examples are made of local river cobble chert and the remaining specimen is made of a possibly heat-treated piece of gray chert. All of these pieces exhibit considerable attrition of the distal working ends. This consists of crushing on one specimen (Figure 18, B) and abrasion (presumably through use) on the others. All four of the smaller endscrapers were recovered from Excavation A.

Four sidescrapers were recovered from Area 741 (Figure 18, F-I). Three were from the disturbed surface of the construction cut and the remaining specimen was discovered in X unit 2 of Excavation A. The excavated specimen (Figure 18, F) is the largest of the sidescrapers. It measures 64 mm long, 45 mm wide and 12 mm thick and it is made on a secondary decortication flake of pale yellow (Hue 2.5Y 7/4) color. The stone is of the typical river cobble derivation. Cortex is visible both on the proximal (striking platform) and distal ends of the flake and these indicate that the flake was struck from a core that was approximately 64 mm in diameter. This is consistent with the river cobble chert core sample from Area 751. A single edge, the left lateral edge, has been prepared

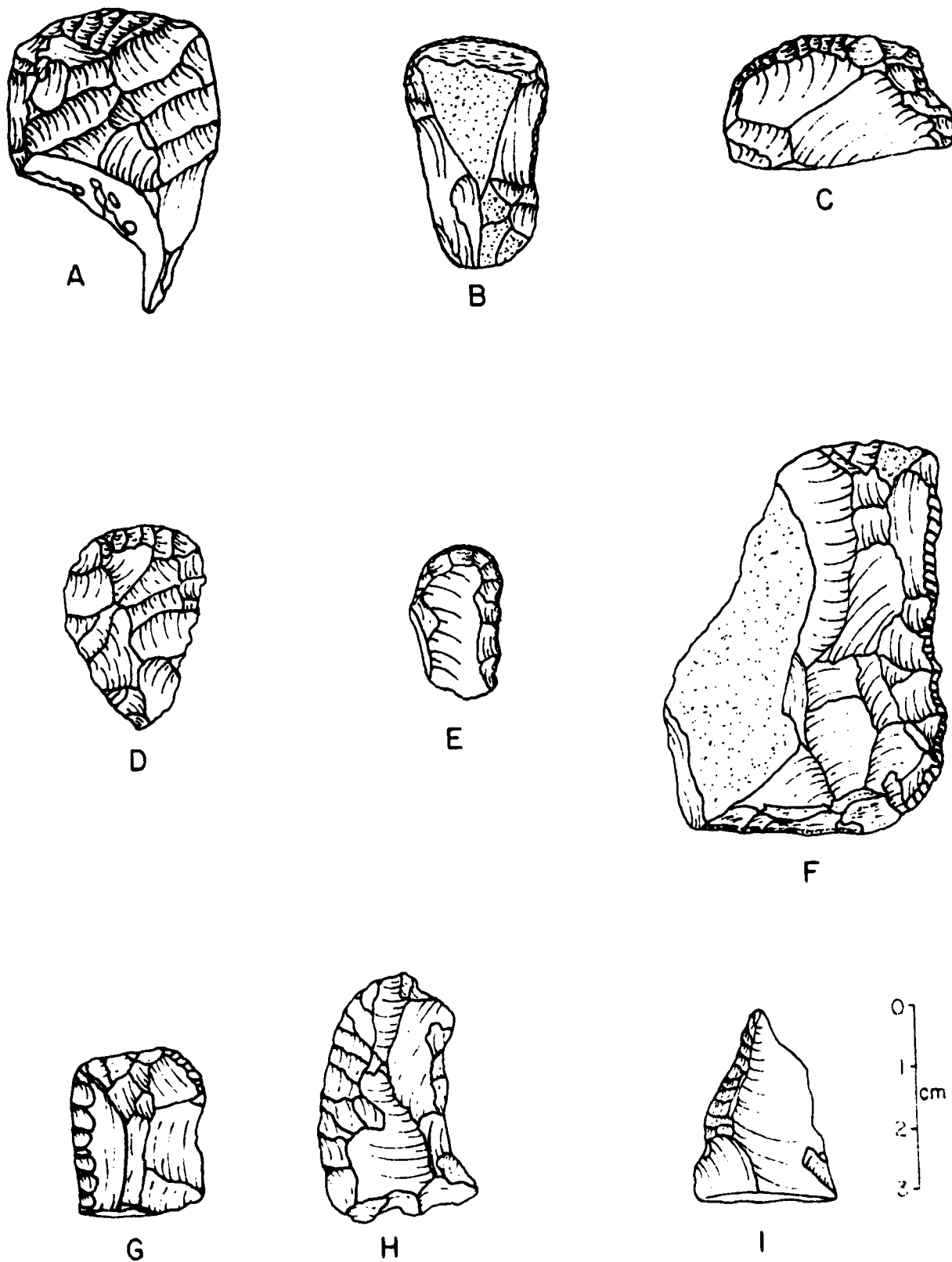


FIGURE 18: 14OS347, Area 751, unifacial implements

with percussion flaking. The distal end shows considerable amounts of hinge fracture that has obviously also resulted from percussion flaking. The specimen does not appear to have been extensively utilized as a scraper or knife. It is possible that the preparation evident on the lateral edge and distal end are the early stages of biface preparation, rather than a conscious attempt to produce a scraper. The remaining three sidescrapers are all made from gray chert (Hue 2.5Y N/5), possibly heat treated. They are all broken specimens that range in thickness from 5 mm to 11 mm. One example (Figure 18, I) is interesting because it has uniface pressure retouch on the dorsal face (as illustrated), and on the opposite lateral ventral face.

Utilized/Modified Flakes: This category includes both flakes intentionally modified by flintknapping techniques and flakes which have experienced modification through utilization (Figure 19, A-O). Potential uses of these tools include, but are not limited to, scraping, cutting, perforating and incising. This is thus quite a heterogenous category of lithic implements. One characteristic shared by all of the specimens so classified is the presence of discontinuous or limited alteration of portions of one or more ends or edges. This alteration typically consists of a series of small and steeply angled flake scars along the worked end or edge which have been produced by steep pressure retouch or by contact of the unmodified edge with some hard material, such as wood, bone or shell, or by a combination of the two processes. Sixty-three flakes from Area 751 were classified as modified/utilized flakes. Forty of these flakes appear to be utilized flakes and 23 flakes were evidently intentionally modified.

TABLE 10: 140S347,
Utilized/Modified Flakes from Area 751

Flake Category	Modified Flake	Utilized Flake	Size Range in Millimeters	
			Smallest	Largest
Primary				
decortication	0	4	31 x 17 x 16	42 x 20 x 5
Secondary				
decortication	1	2	25 x 19 x 4	45 x 23 x 5
Core reduction	8	17	17 x 12 x 4	47 x 42 x 14
Biface thinning	4	3	20 x 11 x 3	27 x 18 x 4
Interior	10	14	10 x 10 x 2	43 x 19 x 3
Total	23	40		

Table 10 illustrates the size range of Utilized/Modified flakes and also indicates from what category of general flake type they were derived. As might be expected, the largest numbers of both modified and utilized flakes are derived from core reduction flakes and internal flakes and a smaller number are derived from primary and secondary decortication flakes and from biface thinning flakes. In core reduction, the resultant flakes are often the end project of the knapping process while, in biface thinning, the resulting flakes are usually a by-product. Primary and secondary decortication flakes are often not suitable for further reduction because of their irregular dorsal surface and because of the presence of soft cortex on this dorsal surface. Illustrations of a variety of utilized and modified flakes are provided on Figure 19, A-O. Of particular interest is a possible burin prepared on an internal flake (Figure 19, D).

Pecked and Ground Stone:

Grinding Stones: Investigations in Area 751 at the Cow-Killer site recovered eight pieces of fine grained sandstone which represent elements of four, or possibly, five grinding stones (Plate 42, A-B). In addition, a nearly complete grinding slab, found in two pieces, was recovered from X unit 14 in Excavation A. This nearly complete specimen (Plate 41) is rectangular in shape and measures 31 cm long, 18.5 cm wide, and is 4 cm thick. It is made from an unburned, fine grained, micaceous sandstone of pale brown color (Hue 10YR 6/3). The specimen was found in a horizontal position with the ground face upward. This face has been partially smoothed by grinding, apparently with a muller, but it is still relatively flat with many of the original irregularities of the unprepared slab still evident.

All of the other eight grinding stone sections are made from fine grained micaceous sandstones that have a color range which includes reddish brown (Hue 5YR 5/3), light brownish gray (Hue 2.5Y 6/2), and grayish brown (Hue 10YR 5/2). All of these pieces have one worked or ground face, and they apparently represent the remains of larger slabs of sandstone which were utilized as grinding slabs. The face opposite the ground face is typically unmodified and more roughened than the ground face. All of them exhibit irregular edges which suggest that they are either broken midsections of larger slabs or that the slabs were irregularly shaped. The largest specimen recovered measures 155 mm in length, 105 mm in width, and is 13 mm in thickness (Plate 42, A). Examination of the wear patterns on the ground faces of the grinding stone sections reveals shallow striations that run in several different directions. The working faces range from faces that are nearly flat to faces that are slightly concave. One of the grinding stone pieces exhibits eight or nine shallow longitudinal grooves towards the lateral edge of one face (Plate 42, B). These

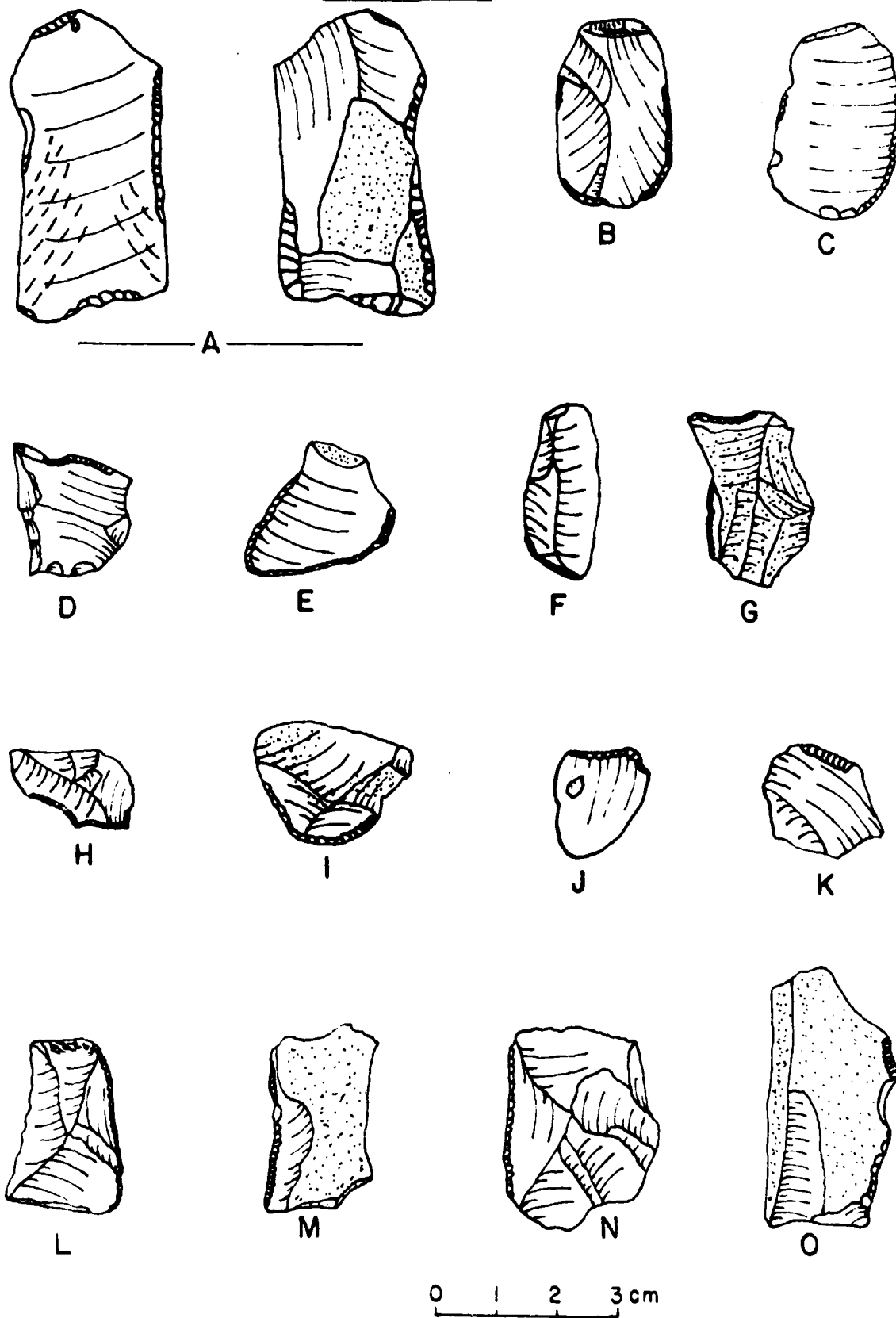


FIGURE 19: 140S347, Area 751, utilized/modified flakes



PLATE 41: 140S347, Area 751, Grinding slab

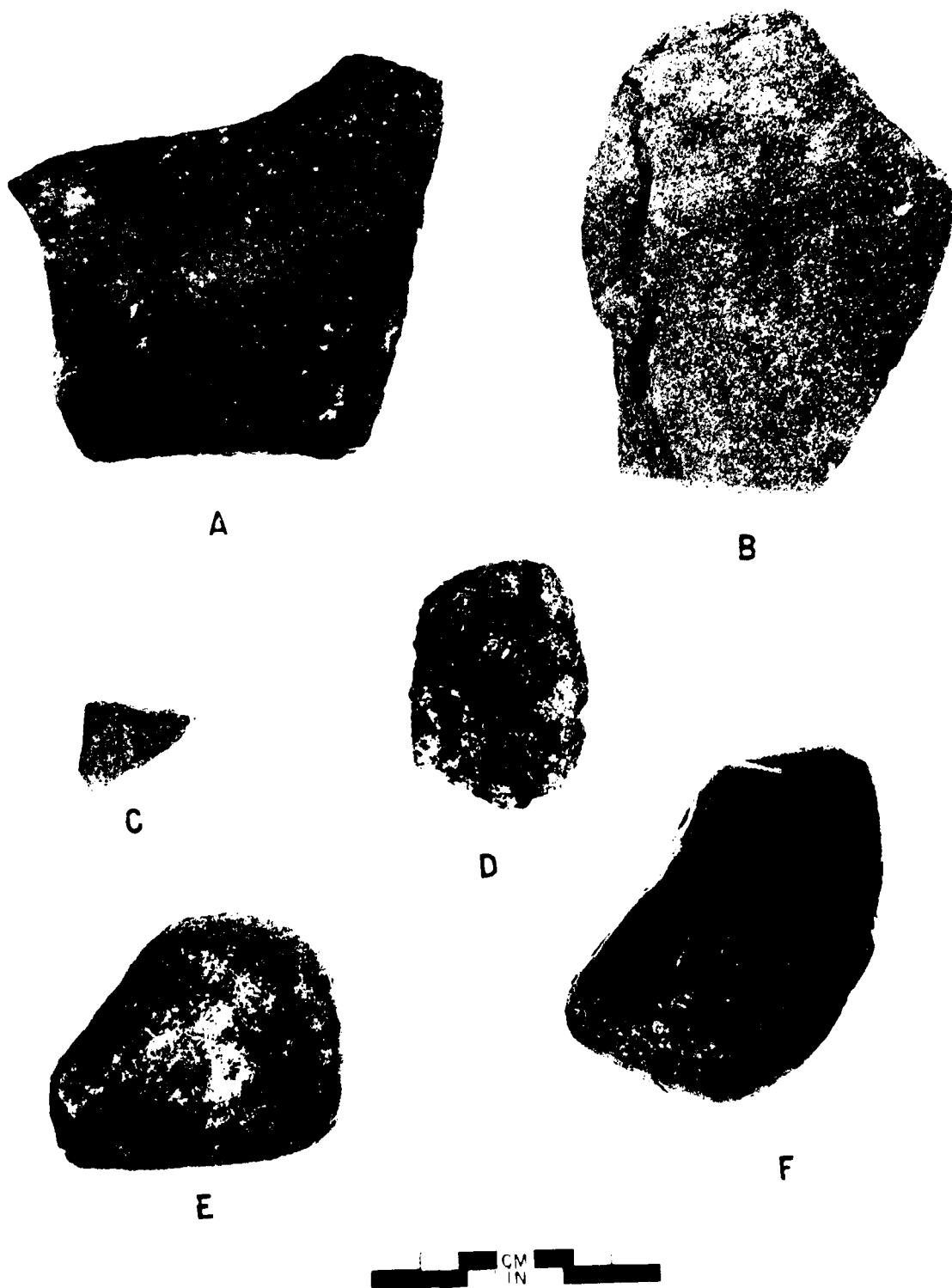


PLATE 42: 140S347, Area 751, Pecked and ground stone

grooves only measure about 7 mm long and are approximately 1 mm to 2 mm in depth and they are deeper indented at one end than at the other. This suggests a possible secondary utilization of this grinding slab as a sharpener for such things as awls.

In addition to the previously described tabular pieces of grinding stone sections, one small additional piece of sandstone exhibits longitudinal grooves on both faces, suggesting utilization as an abrading stone (Plate 42, C). This piece is very small, measuring 34 mm long by 23 mm wide by 10 mm thick, and it is evidently a small section of a larger grinding tool. One additional piece of stone from Area 751 appears to be an abrading stone (Plate 42, D). This piece is made from a coarse piece of limestone that has evidently been in a fire. It measures 65 mm by 46 mm by 26 mm in thickness and it has one slightly flattened face that has a longitudinal groove running the entire length of the piece. This groove is somewhat V-shaped in cross-section and it has a maximum depth of 3 mm, with a width at the top of 4 mm to 5 mm. This object would be a good candidate for an abrading stone for edge preparation for bifaces.

Mullers: One incomplete muller was recovered during the investigations of Area 751 (Plate 42, E). This specimen was recovered from X unit 24 in Excavation B in the central dike area. The specimen is made from a somewhat coarse grained and micaceous sandstone and it is a light yellowish brown (Hue 10YR 6/4) in color. The specimen is apparently subrectangular in plan view with rather vertical edges and, while no determination of length can be made, the specimen is 63 mm wide and 30 mm thick. It is possible that the original specimen was somewhat thicker, as the unworked face is quite irregular.

Pecked Stone: A single example of a hammerstone was recovered from Area 751 (Plate 42, F). This example is a somewhat irregularly shaped cobble of a dark colored diorite which measures 100 mm long by 60 mm wide by 45 mm thick. The specimen was found in two pieces in separate excavation units in Excavation A, suggesting that the hammerstone was broken and discarded by the inhabitants, rather than through later agencies. The more bulbous end of the specimen exhibits the most evidence of its pecking function and this is revealed by a series of peck marks running along the lateral edges of this end. The other end has also been lightly pecked. This would appear to be the one object from Area 751 which functionally could be classified as a hammerstone for producing lithic tools. That it was not heavily used for this purpose is evident by the fact that its faces do not reveal evidence of extensive battering or pecking.

Pigment: Seven small pieces of hematite and two fragments of limonite were recovered from Area 751. These are all badly eroded

and it is difficult to tell whether or not any of them has been used or modified in any way. However, they are soft enough that they certainly could have been ground and used as pigment by the prehistoric inhabitants.

Other: One additional stone specimen, recovered from Feature 163 complex in X unit 2 of Excavation A, is a section of limestone that is typical of the rest of the limestone recovered from the Cow-Killer site. It is unburned and measures 90 mm long by 55 mm wide by 20 mm thick and is somewhat rectangular in shape in plan view. What makes this specimen unusual is the presence of a circular hole, measuring 32 mm in diameter, in the center of the specimen. The specimen is so weathered that we are unable to determine whether or not this hole is of intentional placement or whether it is a natural feature of the rock. Nevertheless, it was noted during excavation and determined at that time not to be a result of any of the excavation activity.

Miscellaneous Stone:

In addition to the stone tools discussed previously, fairly large quantities of limestone and some sandstone were recovered from Area 751. Much of the limestone (which has a natural yellow-brown color) had been burned and exhibited colors in the red hues. The largest concentrations of limestone occurred in the previously discussed trash and midden areas, particularly Features 163, 228 and 180 in Excavation A. Pit 1, Feature 312, had a burned limestone concentration intruding into its orifice and Hearth 2 was lined with burned limestone fragments. In addition, single fragments of limestone were encountered randomly throughout Excavations A and B. Additional unworked stone recovered from Area 751 included unmodified river chert pebbles and cobbles, unworked fragments of hematite and limonite, and rounded, small, unidentified pebbles.

Worked Bone and Antler:

Worked bone and antler implements and ornaments, while present in Area 751, were somewhat sparsely represented. Four antler sections were recovered which show evidence of modification by shaping or utilization or a combination of these two processes (Plate 43, A-C). Ten bone sections, all of animal leg bones, have been considerably modified to form tools and ornaments.

Antler Flakers: Two detached antler tines, one with a still present and blunted tip, were recovered from Area 751. This more complete specimen measures 11 mm in diameter at its thickest point and the specimen measures 57 mm long, although an undeterminable amount of the butt end is missing (Plate 43, A). The extant portion of the tip end reveals a blunted tip with many small facets contained

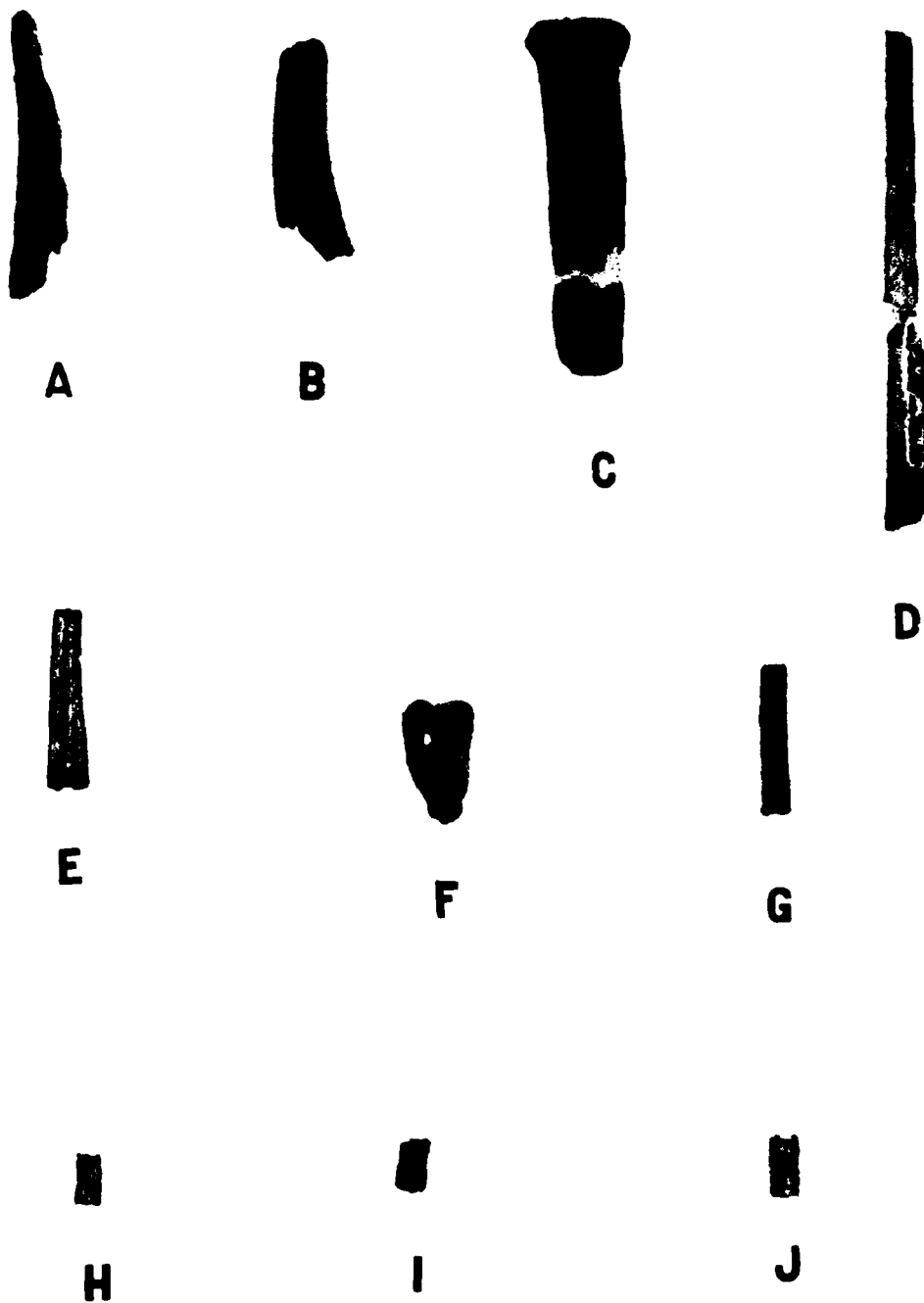


PLATE 43: 140S347, Area 751, Worked bone and antler

upon it such as occur through application of similar tines in pressure flaking of silicates. The specimen does not show evidence of resharpening when examined under a binocular microscope, so it was presumably used little. The second possible pressure flaker is a 41 mm long section of antler which is missing both tip and butt ends (Plate 43, B). This specimen has a maximum diameter of 12 mm. Attribution of this antler section to the class of pressure flaker is tentative. The object conforms well in size to the first specimen. Possible grinding striations running longitudinal with the long axis of the antler tip were observed at 40 power magnification under a binocular microscope.

Antler Cylinder: A carefully prepared antler cylinder was recovered from the fill of a shallow basin in X unit 19 in Area 751 (Plate 43, C). This specimen measures 67 mm long and has an average diameter of 14 mm. The object is made from the butt end of a deer antler that apparently was shed by the animal rather than obtained from a killed animal. This butt portion is still present and, although considerably shaped by grinding, creates a notable swelling at this end of the specimen. That the artifact is a complete specimen is obvious. The distal end, opposite the proximal butt end, has been carefully cut and flattened to produce a slightly rounded tip end. Longitudinal striations, apparently produced with a hard and sharp implement such as a chert flake, are observable with the naked eye on the long axis of the cylinder. A function cannot be assigned to this object at this time. The object appears to be too light to have functioned as a billet or baton in flintknapping and it also lacks evidence of utilization for this purpose. It could be an intermediate punch for indirect percussion flaking, but it lacks any utilization marks, such as crushed and battered ends, to indicate that it was used in that manner. Several antler objects of nearly identical size and construction were noted by the author in a donated collection of materials from the Trowbridge site, 14WY1, an important Kansas City Hopewell site located in Kansas City, Kansas. These implements also lacked evidence of intensive utilization although their slightly larger size, on the average, suggested possible flintknapping applications.

Antler Tip: A small tip section of a subadult deer tine was recovered from a midden area in X191 at Area 751. This specimen measures 16 mm long, has a maximum diameter at the butt end of 8 mm, and tapers to a fairly sharp point. It appears to be a complete artifact, but its function is unknown. In fact, firm evidence of intentional shaping of the antler tip is lacking as the specimen is weathered badly.

Bone Awls: One bone awl section and a portion of a second possible awl were recovered from Area 751. The first of these is incomplete and is missing both tip and butt (Plate 43, D). It appears to be made from a mammal long bone, possibly a deer metapodial. The extant portion measures 95 mm long, has a butt section diameter of 9 mm and a tip section diameter of 5 mm. One-half to two-thirds of the complete object appears to be present. Intentional and quite careful shaping is demonstrated. Shallow scraping grooves (some are 1.5 mm wide) are visible on the long axis of the awl and they indicate that shaping was accomplished with a sharp silicate flake. In cross-section, the specimen is round with one slightly flattened side. The second possible awl section was recovered from the fill of Feature 258, a complex of trash identified in X unit 14 in Area 751 (Plate 42, E). This specimen is a 35 mm long section of polished animal long bone that is somewhat oval in cross-section with a width of 7 mm and a thickness of 4 mm. It appears to have been made from the long bone of a medium size mammal.

Pierced Deer Phalanx: This specimen consists of a section of a medial deer phalanx which has had a small hole drilled or pierced in it on the side and toward the distal end (Plate 43, F). The hole measures 2 mm in diameter and is slightly oval. The function of this object is unknown.

Bone Beads: Eight complete or fragmentary tubular bone beads were recovered from several different locations within Area 751. The largest of these, and the only one which is identifiable as to bone unit and animal species, was recovered in a midden, Feature 127, in the grader cut which connected the two stabilization ponds. This specimen is 29 mm long and somewhat triangular in cross-section with a maximum diameter of 7 mm (Plate 43, G). It has been made from a section of the right tibia of *Sylvilagus floridanus*, the cottontail rabbit. While the bone tube has been left unmodified, the two ends show clearly that they were grooved with a sharp tool, presumably a stone flake, all the way around the circumference, and thus separated from the parent bone. A slight lip of this grooving process remains at both ends of the tubular bead.

A second tubular bead was recovered from the fill of a deep trash-filled pit, Feature 312. This specimen could not be identified as to bone part or animal species although its size suggests an animal of the approximate size of a cottontail. This example measures 9 mm in diameter and 20 mm long and it is slightly oval in cross-section. Rodent gnawing at both ends has obscured evidence for method of manufacture.

Another tubular bone bead, unfortunately incomplete, was recovered from the general fill of X unit 9. The extant section suggests a bead of at least 7 mm diameter and a length in excess of 15 mm. A portion of one end is present and it has the same type of grooving, perpendicular to the long axis, exhibited on the first bone bead discussed above.

The remaining five tubular beads are all quite similar and can be described together (Plate 43, H-J). All were recovered in Excavation B in the central dike location of Area 751. While only one of these is complete, all are sufficiently complete to measure and to observe method of manufacture. The basic manufacturing process was identical to that described for the other beads. Animal long bones were grooved, probably with a sharp stone flake, all around the circumference, and then snapped. All five examples contain ends which still reveal the grooving. These five specimens are quite uniform in size with thicknesses of 5 to 6 mm and lengths from 10 to 11 mm. What distinguishes them from the first three beads is the presence of another circumferential groove midway on the shaft of each. These grooves are 1 mm wide and 0.5 mm deep. Thus, they nearly bisect the beads.

Burned Daub and Burned Earth:

A large amount of fired clay daub, in excess of 900 pieces, was recovered from Cow-Killer site. While virtually every basin and storage area within Excavation A and B of Area 751 contained burned daub, the bulk of the material came from the westernmost line of squares in Excavation A, including excavation units 25, 26, 27, and 28 and in lesser amounts in excavation units 1, 5 and 9. Excavation units 25, 26, 27 and 28 formed the most westernmost dike area because it was in this area that the sloping side of the central dike had been excavated to create the westernmost of the two stabilization ponds. Considerable daub was also encountered throughout Excavation B.

The daub fragments are untempered and are consistently reddish yellow to light brown to brown to strong brown in color (Hue 7.5YR) (Plate 44, A-K). Some pieces also exhibit more black color. The largest daub section recovered from the site measured 70 mm by 40 mm by 20 mm and they then ranged in size down to very small pieces. In excess of 900 specimens of burned daub were recovered from the site which could have a catalogue number placed upon them because they were sufficiently large, and a number of smaller specimens were bulk catalogued by level and X unit in plastic vials. The daub pieces range in shape from somewhat slab-shaped pieces with grass impressions

on both sides (Plate 44, A-D), to irregular-shaped pieces and somewhat curved pieces that have grass impressions on one side and distinct pole impressions on the other side (Plate 44, E-K). On some pieces of daub, it is evident that the grass was part of the matrix of moist clay or was mixed with this matrix of moist clay before being applied, presumably to a house structure. More commonly however, the clay has impressions of grass, twigs or poles on one or more faces, but there is no evidence that these materials have been mixed into the matrix of the clay. Measurement of the stem impressions indicates a stem diameter range from less than 1 mm to 3 mm in size (Plate 44, F-H). Specimens demonstrating pole impressions suggest poles ranging in diameter from 15 mm to in excess of 40 mm in diameter (Plate 44, I-K).

In addition to the burned daub recovered in Area 751, fragments of burned earth or burned clay were encountered throughout the entire excavation. These were usually small, 25 mm or less in diameter, and they lacked any evidence of either grass or pole impressions. They also lacked any evidence of temper of any kind. These are interpreted to be the residue of burned earth that occurs wherever open fires are built on or in the ground. They exhibit the same color range as the daub fragments except that more of them exhibit darker colors.

Portions of two mud dauber nests were recovered from Area 751. One of these was recovered from the fill of Basin 6 and the second specimen was recovered from X unit 2 in Excavation A at an elevation between 969.62 and 970.12 ft above mean sea level. Mud dauber wasps belong to the insect order *Hymenoptera* and, more specifically, are of the family *Sphecidae* (Gates and Peters 1962:227-278). Several genera and species of mud daubers are known from Kansas (Gates and Peters 1962:277-278). Mud daubers typically nest in protected areas, such as on rocks, trees, or on buildings. Both of the recovered specimens exhibit portions of the interior cells as well as the external clay plastering and both have been burned. Mud dauber nests are features often associated with prehistoric structural remains in Kansas. The presence of these two burned specimens in the general area of one or more burned structural remnants at the Cow-Killer site is certainly not merely a fortuitous occurrence. They are very likely associated with the structure or structures. The nesting season for mud dauber wasps is from early summer to fall so, presumably, a structure was standing in Area 751 during at least one of these seasons. Freimuth and LaBerge note that mud daubers are active in the St. Louis, Missouri vicinity from about May 15 to October 15 (1976:112). They further note that while it is not possible to date archeological sites simply by the presence of mud dauber nests, their presence does indicate that a structure, either inhabited or vacant, was standing during those months.

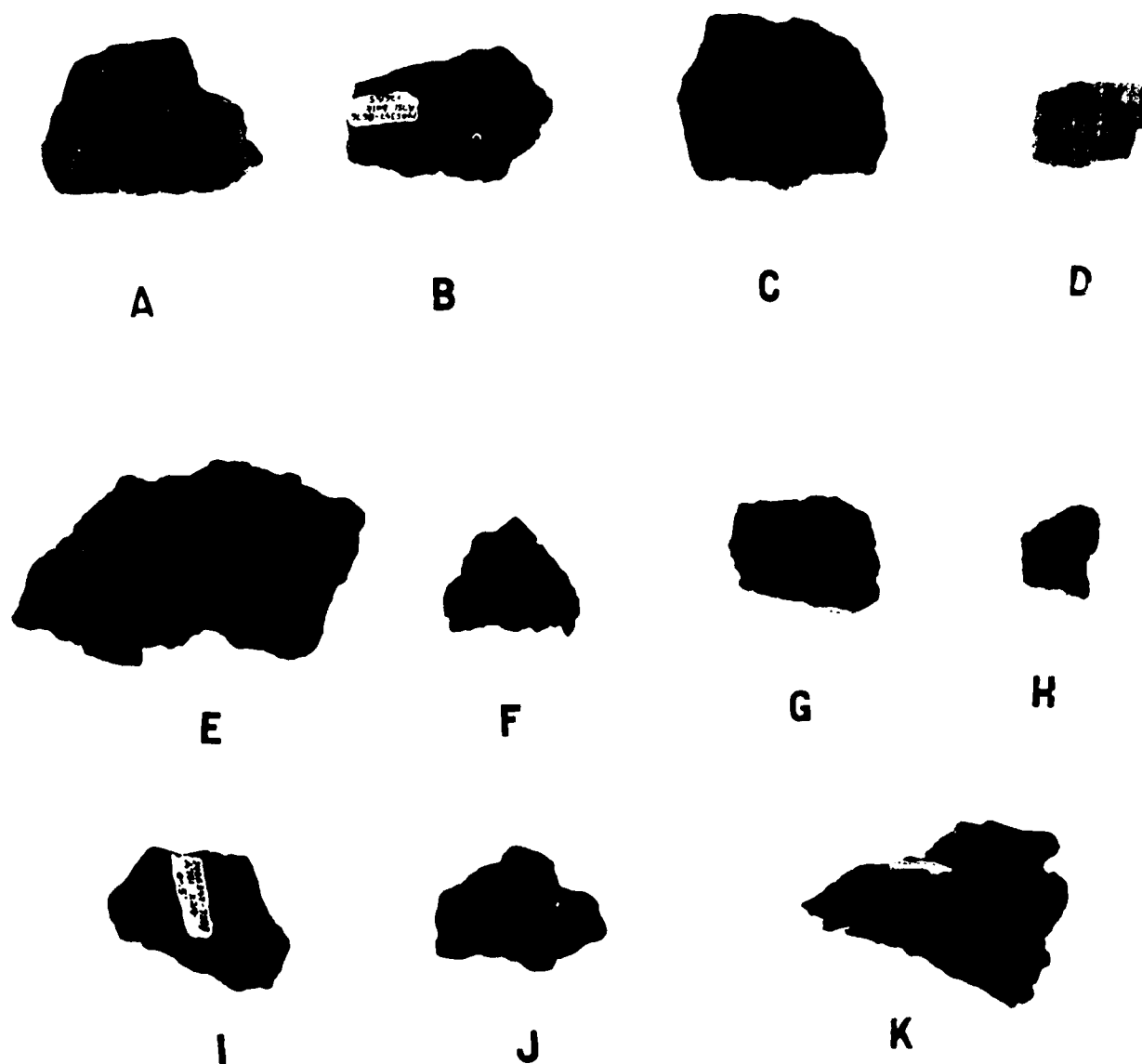


PLATE 44: 140S347, Area 751, Burned daub

Fauna and Flora:

Faunal Remains: A large quantity of faunal material was recovered from Area 751 at the Cow-Killer site. This included 2,681 individually catalogued specimens and additional small animal bones and bone fragments which were bulk catalogued by feature or X unit and placed in appropriately labeled containers. These specimens were recovered both during excavation and by subsequent water screening of selected fill samples from hearths, pits and basins. Most of the osteological material is in good condition and between 15 percent and 20 percent of the total sample is burned.

Table 11 provides a detailed list of the recovered faunal remains by identified bone unit, genus, species, and family. Table 12 provides more generalized information, as it summarizes the number of bone units for each represented species and contains information about the minimum number of individual animals represented in the sample. It is possible that additional bone units in the sample are identifiable, particularly some of the small rodent bones. The larger unidentifiable bones are in such a fragmentary state that it is doubtful if they can be further identified. Calculation of minimum number of individuals represented for each species was done quite conservatively. The minimum number of individuals was determined by counting the largest number of any one diagnostic bone, e.g., right tibia, for each species (Daly 1969:150). In one case, *Bison bison*, the presence of both adult and subadult bones in the sample was utilized to determine a minimum number of two. Since all of the faunal material from Area 751 was recovered from the Greenwood phase occupation, and since vertical stratigraphy was virtually absent within this 2 ft thick zone, all faunal materials were lumped together in computing minimum number of individuals. Grayson has termed this the "minimum distinction method" and he has noted that it is likely to yield the smallest minimum number of individuals of any of the methods used for such estimations (1973:434). If vertical stratigraphic zones had been discernible during excavation, it is likely that the minimum number of individuals for at least some species would be somewhat higher.

As is common at habitation sites, most of the recovered osteological specimens from Area 751 are representative of butchering activities. Thus, with the exception of a few whole bones, occasional bone units (i.e., a portion of a deer foot), and one complete skeleton of an immature bobcat, most of the bone units of large and medium sized animals are in a broken or fragmentary state. Conversely, small animal bones, particularly various rodent bones, exhibited a much higher incidence of complete bones. This would seem to indicate that

TABLE 11: 140S347,
Area 751, Faunal Remains

<u>Animal</u>	<u>Bone Element</u>	<u>Number</u>
Family: <i>Cervidae</i>		
<i>Odocoileus</i> (prob. <i>virginianus</i>)		
white tailed deer	Antler	7
	Cranial fragments	3
	Maxilla	1 (subadult)
	Mandible (indet. side)	4 (2 subadults)
	Left	2
	Right	2
	Vertebra	22
	Innominate	1
	Scapula	4 (1 subadult)
	Left	1
	Right	1
	Humerus (indet. side)	2
	Left	1
	Right	1
	Left Radius	1
	Right Radius	3
	Ulna (indet. side)	2
	Left	1
	Right	3
	Femur	3
	Tibia (indet. side)	2
	Left	1
	Rib	6
	Metapodial	33 (1 subadult)
	Right Metatarsal	5
	Left Metatarsal	1

TABLE 11 (Continued)

<u>Animal</u>	<u>Bone Element</u>	<u>Number</u>
Family: <i>Cervidae</i> (continued)	Tarsal fragment	6
	Carpal fragment	9
	Right Astragalus	3
	Left Astragalus	2
	Calcaneous (indet. side)	1
	Left	2
	Right	4
	Left Moleolus	1
	Sessamoid	2
	Left Cuneiform	1
	Phalanx	24 (1 subadult)
	Long bone frag- ments	30
	Teeth fragments (indet.)	16 (4 subadult)
	Incisor	1
	Premolar (indet.)	5
	First	1
	Second	1
	Third	4
	Fourth	2
	Molar (indet.)	12 (1 subadult)
	First	2
	Second	4
	Third	2
	Miscellaneous bone fragments	<u>1,273</u> (1 subadult)
	Total	1,521
Family: <i>Cervidae</i>		
<i>Cervus canadensis</i>		
wapiti	Right Calcaneous	1 (subadult)
	Right Astragalus	1 (subadult)
	First Molar	<u>1</u>
	Total	3

TABLE 11 (Continued)

<u>Animal</u>	<u>Bone Element</u>	<u>Number</u>
Family: <i>Bovidae</i>		
<i>Bison bison</i>	Cranial fragment	1
	Left Mandible	1
	First Molar	1
	Second Molar	2
	Third Molar	1 (subadult)
	Vertebra	1 (subadult)
	Rib	6
	radius	1
	Femur (indet. side)	1
	Left	1
	Tibia (indet. side)	2
	Left	1
	Metapodial	5 (3 subadult)
	Metatarsal	3 (1 subadult)
	Left	1
	Right Astragalus	1
	Phalanx	6 (1 subadult)
	Long Bone frag- ments	25
	Bone fragments	<u>19</u>
	Total	79
Family: <i>Leporidae</i>		
<i>Sylvilagus floridanus</i> cottontail rabbit	Right Mandible sec- tion	1
	Left Mandible sec- tion	2
	Mandible fragment	1
	Right Scapula	2
	Right Tibia	1

TABLE 11 (continued)

<u>Animal</u>	<u>Bone Element</u>	<u>Number</u>
Family: <i>Leporidae</i> (continued)	Right Humerus	1
	Femur	2
	Metapodial	<u>3</u>
	Total	13
Family: <i>Leporidae</i>		
<i>Lepus californicus</i>		
jack rabbit	Left femur	1
Family: <i>Procyonidae</i>		
<i>Procyon lotor</i>		
raccoon	Maxilla section	3
	Left Mandible section	3
	Right Mandible section	3
	First Premolar	1
	Second Premolar	1
	Fourth Premolar	1
	Molar	3
	First Molar	1
	Second Molar	1
	Right Humerus	2
	Left Humerus	2
	Right Ulna	1
	Femur	1
	Phalanx	<u>1</u>
	Total	24
Family: <i>Castoridae</i>		
<i>Castor canadensis</i>		
beaver	Right Molar fragment	2

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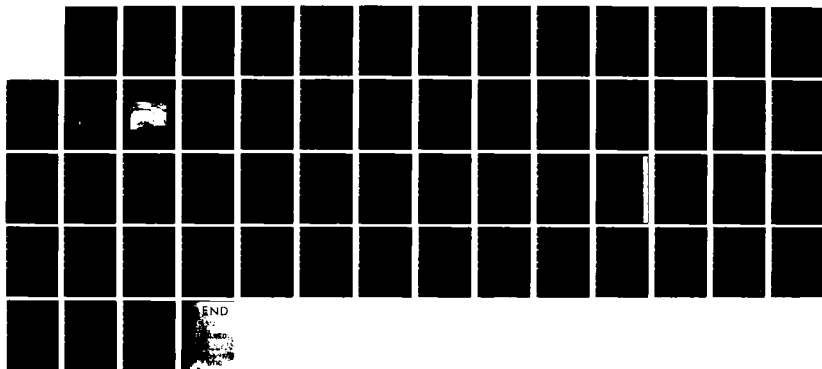
ARCHEOLOGICAL INVESTIGATIONS AT THE COW-KILLER SITE
1405347(U) KANSAS STATE HISTORICAL SOCIETY TOPEKA
ARCHEOLOGY DEPT J D REYNOLDS SEP 82 DACW41-77-A-0532

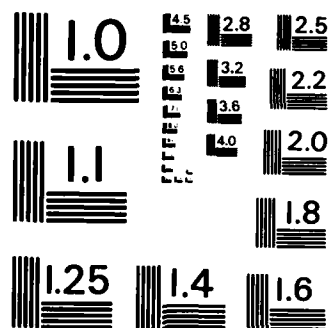
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MICROCOPY RESOLUTION TEST CHART
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TABLE 11 (Continued)

<u>Animal</u>	<u>Bone Element</u>	<u>Number</u>
Family: <i>Castoridae</i>		
<i>Castor canadensis</i> beaver	First Molar	1
	Third Molar	<u>1</u>
	Total	4
Family: <i>Canidae</i>		
<i>Canis latrans</i> coyote	Left Mandible	1
	First Molar	1
	Left Humerus	1
	Phalanx	<u>2</u>
	Total	7
<i>Canis familiaris</i> dog	Left Mandible section	1
	Maxilla section	<u>1</u>
	Total	2
<i>Canis lupus</i> (or very large <i>Canis latrans</i>) wolf	First Molar	1
<i>Canis</i> (indeterminate species)	Cranial fragments	12
	Frontal/Sagital section	1
	Canine	6
	Right Tibia	1
	Phalanx	2
	Metacarpal	<u>1</u>
	Total	23
Family: <i>Felidae</i>		
<i>Lynx rufus</i> bobcat	One complete skele- ton of a subadult-- removed while still articulated in a plaster cast	1

TABLE 11 (Continued)

<u>Animal</u>	<u>Bone Elements</u>	<u>Numbers</u>
Family: <i>Felidae</i> (continued)	Right Mandible	1
	Second Right Metacarpal	<u>1</u>
	Total	3
Family: <i>Sciuridae</i>		
<i>Spermophilus</i> (species indeterminate) ground squirrel	Left Scapula fragment	1
<i>Cynomys</i> (species indeterminate) prairie dog	Right Mandible section	2
	Left Humerus	<u>1</u>
	Total	3
<i>Sciurus niger</i> fox squirrel	Left Humerus	1
Family: <i>Talpidae</i>		
<i>Scalopus aquaticus</i> eastern mole	Humerus fragment	1
	Left Humerus	1
	Right Femur	<u>1</u>
	Total	3
Family: <i>Mustelidae</i>		
<i>Mustela vison</i> mink	Left Femur	1
Family: <i>Geomyidae</i>		
<i>Geomys bursarius</i> Pocket gopher	Left Mandible section	3
	Right Mandible section	1
	Maxilla section	<u>1</u>
	Total	5

TABLE 11 (Continued)

<u>Animal</u>	<u>Bone Elements</u>	<u>Number</u>
Family: <i>Cricetidae</i>		
<i>Reithrodontomys megalotis</i> western harvest mouse	Left Femur	1
<i>Onychomys</i> (species indet., possibly <i>leucogaster</i>) northern grasshopper mouse	Right Humerus	1
<i>Neotoma</i> (species indet.) woodrat	Right Femur	1
Mammal bones (indeterminate genus and species) rodent size	Mandible	8
	Incisor	6
	Tooth	2
	Cranial	1
	Vertebra	2
	Left Ulna	1
	Femur	1
	Tibia	2
	Metapodial	2
	Maxilla	1
	Long bone	2
	fragments	<u>13</u>
	Total	41
Small-sized mammal	Vertebra	1
	Rib	1
	Long bone	17
	Bone fragments	52
	Burned bone fragments	<u>3</u>
	Total	75
Medium-sized mammal	Cranial fragment	2
	Vertebra	1
	Tooth	1

TABLE 11 (Continued)

<u>Animal</u>	<u>Bone Elements</u>	<u>Number</u>
Medium-sized mammal (continued)	Rib	1
	Bone fragments	<u>130</u>
	Total	135
Carnivore (indeterminate)	Mandible	2
	Tooth	1
	Incisor	<u>1</u>
	Total	4
Large mammal	Bone fragments	506 (85 burned)
Birds		
<i>Tympanuchus cupido</i> greater prairie chicken	Tibiotarsus	1
<i>Tympanuchus</i> (species indet.)	Ulna	1
<i>Meliagris galopova</i> wild turkey	Carpometocarpus	2
<i>Speotyto cunicularia</i> burrowing owl	Ulna	1
	Radius	<u>1</u>
	Total	2
Hawk size	Humerus	1
	Ulna	1
	Tibiotarsus	1
	Long bone	1
Smaller than wild turkey	Tibiotarsus	1
Unidentified bird	Long bone	8
Turtle	Carapace sections	138
Snake	Vertebra	4
Family: <i>Unionidae</i>		
<i>Crenodonta peruviana costata</i>	Left Valve	6
	Right Valve	8
Genus and species indet.		46
Gastropoda		1 (small vial several specimens)

TABLE 12: 14OS347,
Faunal Remains, Totals

Animal	Bone Units No.	Minimum No. Individuals
<i>Cervidae</i>		
<i>Odocoileus virginianus</i>	1,521	4
<i>Cervus canadensis</i>	3	1
<i>Bovidae</i>		
<i>Bison bison</i>	79	2
<i>Leporidae</i>		
<i>Sylvilagus floridanus</i>	13	2
<i>Leporidae</i>		
<i>Lepus californicus</i>	1	1
<i>Procyonidae</i>		
<i>Procyon lotor</i>	24	3
<i>Castoridae</i>		
<i>Castor canadensis</i>	4	1
<i>Canidae</i>		
<i>Canis latrans</i>	7	1
<i>Canis familiaris</i>	2	1
<i>Canis lupus</i>	1	1
<i>Canis</i> (species indet.)	23	2
<i>Felidae</i>		
<i>Lynx rufus</i>	3	2
<i>Sciuridae</i>		
<i>Spermophilus</i> (species indet.)	1	1
<i>Cynomys</i> (species indet.)	3	2
<i>Sciurus niger</i>	1	1
<i>Talpidae</i>		
<i>Scalopus aquaticus</i>	3	1
<i>Mustelidae</i>		
<i>Mustela vison</i>	1	1

TABLE 12 (Continued)

Animal	Bone Units No.	Minimum No. Individuals
<i>Geomyidae</i>		
<i>Geomys bursarius</i>	5	3
<i>Cricetidae</i>		
<i>Reithrodontomys</i> <i>megalotis</i>	1	1
<i>Onychomys</i> (species indet.)	1	1
<i>Neotoma</i> (species indet.)	1	1
Bones of rodent-sized mammals	41	
Bones of small mammals	75	
Bones of medium-sized mammals	135	
Bones of large mammals	506	
Bones of carnivores	4	
Birds		
<i>Tympanuchus cupido</i>	1	1
<i>Tympanuchus</i> (species indet.)	1	1
<i>Meliagris galopova</i>	2	1
<i>Spectyto cunicularia</i>	2	1
Hawk size	4	
Smaller than wild turkey	1	
Unidentified bird	8	
Turtle	138	
Snake	4	
<i>Unionidae</i>		
<i>Crenodonta peruviana</i> <i>costata</i>	14	8
Unidentified mollusc	46	
Gastropoda	1 (small vial w/ several specimens)	

the small animals were not a significant dietary item for the Greenwood phase inhabitants. Butchering marks are present on many of the skeletal units, particularly deer and bison, and postdepositional rodent gnawing marks also commonly occur. Evidence of butchering marks typically consists of cut marks and fractures of long bones. The cut marks are primarily observed on the ends of long bone sections, especially in the areas of joints or articulations. These marks are characteristically short in length, apparently produced by chert flakes, knives or celts, and they run perpendicular to the long axis of the specific bone unit. While a complete analysis of butchering techniques of the Area 751 inhabitants has not yet been undertaken, butchering marks are present on bones of virtually all presumed game mammals and birds (as listed in Table 13) and butchering evidence is much sparser for the smaller, and presumably naturally occurring, species.

As Table 12 indicates, white tailed deer, *Odocoileus virginianus*, was the best represented animal species in the faunal sample in terms of sheer number of bones present. Identified deer remains constituted 57 percent of the entire faunal sample in Area 751 and they comprised 90 percent of the identifiable (species or genus) sample of mammal bones. At least 12 of the identified deer bones represent subadult animals and one white tailed deer bone is that of a very old individual. The next most frequently occurring species, *Bison bison*, was represented by only 79 identifiable bones. Thus, less than 3 percent of the entire faunal sample is definitely bison and they comprise only 5 percent of the identifiable mammal bone sample.

As Daly (1969) has noted, the total number of bone units present at a site is not necessarily the most reliable method for inferring diet. A better method, according to Daly, is to determine the minimum number of individuals present for each species and then to calculate the relative meat weight available for each species (1969:151). Using this method, some biases of cultural selection can be avoided in determining the importance of certain species to the prehistoric diet. For example, smaller or more readily accessible animals are more likely to be brought back as complete carcasses while larger animals may have been butchered at or near the place where they were killed. Many heavy bone units might not show up in a faunal inventory from a campsite. As Table 13 indicates, this may be precisely the situation present in Area 751 at the Cow-Killer site. Table 13 derives percentages or ratios of available meat based on the minimum number of individuals represented for each species, or genus, in the Area 751 faunal sample. Species included are those mammal and bird species which are thought to have been a part of the diet of the Greenwood phase peoples at this site. Excluded species are, by and large, small mammals which are not believed to have been protein sources for the prehistoric inhabitants. Two probable protein sources,

TABLE 13: 140S347, Area 751
Percent of Useable Meat of Game Mammals and Birds
Based on Minimum Number of Individuals by Identified Bone Units

Genus/Species	Estimated lbs. useable meat per individual	Minimum No. Individuals	Total useable flesh weight in lbs.	Percent of useable flesh
<i>Odocoileus virginianus</i>	100	4	400	21.19
<i>Cervus canadensis</i>	350	1(subadult)	175	9.27
<i>Bison bison</i>	650	2(1 subadult)	975	51.66
<i>Sylvilagus floridanus</i>	1.75	2	3.5	.19
<i>Lepus californicus</i>	3	1	3	.16
<i>Procyon lotor</i>	17.50	3	52.5	2.77
<i>Castor canadensis</i>	38.50	1	38.50	2.04
<i>Canis (all species)</i>	42.5	5	212.5	11.26
<i>Lynx rufus</i>	12	2(1 butchered)	12	.64
<i>Cynomys (species indet.)</i>	1.50	2	3	.16
<i>Sciurus niger</i>	.50	1	.50	.03
<i>Mustela vison</i>	.50	1	.50	.03
<i>Tympanuchus (prob. cupido)</i>	1.40	2	2.80	.15
<i>Meliagris galopova</i>	8.5	1	<u>8.5</u>	.45
		Total	1,887.3	

molluscs and turtles, were excluded from the list because of difficulties encountered in arriving at minimum numbers of individuals and/or reliable estimates of useable meat.

Considerable difficulty was encountered in arriving at estimates of useable meat for the species listed in Table 13. White (1953) suggested that percentages of total animal weight be utilized in computing useable meat poundage. He has further suggested that 50 percent of average weight be used to calculate useable meat poundage for "stockers and feeders" such as deer and bison and that 70 percent of average weight be used for "heavy bodied, short legged" species (White 1953:397). While White's percentages have met with some criticism in the archeological community (i.e., Stewart and Stahl 1977), they nevertheless provide a basic framework for computing useable meat ratios and they have been utilized with some success in Plains archeological studies (i.e., Gilbert 1969; Grange 1980). Gilbert's estimates of average live weights and percent of useable meat of game animals and birds was used in the preparation of Table 13 since most species present in Area 751 are included in Table 6 of his report (1969:285). Data on species missing from Gilbert's list were obtained from Hall and Kelson (1959) and Grange (1980).

As Table 13 indicates, bison, which are under-represented in terms of numbers of bone units in Area 751, may actually have accounted for over 50 percent of the protein requirements of the Greenwood phase inhabitants. Deer, the most abundantly represented faunal remains in terms of bone units, comprised approximately 20 percent of useable flesh. Two other categories, elk and canids, each account for approximately 10 percent of useable flesh. As is shown in Table 11, not all bison bone units are represented in the Area 751 sample. Conspicuous by their absence are any of the bones of the pelvis. Cranial elements are represented by a single example. While these absences or under-representations, may indicate selective butchering techniques, the sample of bison bone (79) is too small to allow for firm conclusions.

The occurrence of molluscs in the Area 751 faunal sample is particularly interesting as no mollusc remains were found in association with Area 741, the primary Archaic cultural level at the Cow-Killer site. Furthermore, the finding of some of the molluscs in a roasting pit, Feature 202, certainly suggests that mussels were a part of the diet of the Plains Woodland inhabitants.

As various authors have noted (i.e., Gabel 1967, Frison 1973, 1978:290-298; Nimmo 1971, Wheat 1972), the chronological age of animal populations as determined from skeletal parts can sometimes be effectively utilized in determining seasonal occupation or

seasonal reoccupation of archeological sites. Such attempts have proven most successful in determining seasonal occupation of short term, special function sites such as bison kills, antelope drives, etc. where an isolable portion or portions of the fauna can be related directly to a single event. Certain bird species, particularly migratory waterfowl, are believed to be particularly sensitive indicators of seasonality (Gabel 1967:23; Chaplin 1971:158-159). The presence of immature animal or bird bones can also indicate seasonality in some cases (Gabel 1967:23; Chaplin 1971:258). As a cautionary note, both Gabel (1967:23 and Chaplin 1971:158) note that bone evidence can only verify seasonality in terms of hunting activity and not in terms of site occupancy. In other words, the presence of certain animal or bird populations in a site's faunal inventory, or the presence of bones of immature individuals, can provide positive evidence for the occupation of a site at a particular season, but it does not rule out the possibility that the site was occupied year around. This is particularly true in situations such as that revealed at the Greenwood phase occupation at the Cow-Killer site. Here, within a 2 ft thick occupation level, more than 2,681 individual faunal elements were recovered. None of the identified species were those of migratory animals or birds. No bones of migratory waterfowl were identified from the sample. As Table 1 in this report indicates, most of the identified fauna from Area 751 are still present in the Melvern lake vicinity. Those species which are not present (e.g., bison, elk, wolf, etc.) were present in the Melvern area until recent times. Only a very small portion of the faunal inventory, 21 bone elements of three species and one nearly complete bobcat skeleton, can definitely be identified as immature or subadult. It would appear that the potential of the Area 751 faunal inventory for providing evidence of either seasonal or year around occupancy is limited at this time. If the age of the immature bobcat skeleton could be reliably estimated, this might provide positive evidence for occupation at a particular time of year. The breeding season for bobcats (*Lynx rufus*) is late winter and the young are born after a gestation period of approximately 50 days (Hall and Kelson 1959:969). Assuming that the recovered skeleton is that of an individual older than three months, but less than one year, we can infer a fall or winter procurement of the animal. Unfortunately, as noted above, the presence of immature animals in a faunal collection can provide firm positive evidence for site occupation at a particular time of year, but it does not demonstrate that the site was vacant at other times.

Flora: While faunal remains were quite abundant in the Area 751 sample, floral remains were disappointingly meager. Aside from fairly abundant and usually small pieces of carbonized wood, only two features within the site (Hearth 1 and Basin 7) contained any

seed remains that could be associated with the Plains Woodland component. Several small (less than 1 mm diameter) fragments of charred seeds were recovered from water screened fill samples in these areas. Fragments of walnut shell (*Juglans*, species indeterminate) were recovered from Basin 6 in Excavation B and several small and unidentifiable nut shell fragments were collected in Basin 7. Notable for its absence from the inventory was any evidence of *Zea mays* or other possible domesticated species. This lack of specimens may in part be due to the very compact soil which was found throughout Area 751. Water screening of fill was difficult and frustrating. Nevertheless, water screened fill did yield other small and fragile materials such as very small animal bones and a few gastropods as well as more durable fragments of denser bone and occasional chert flakes.

Subsistence:

In general, the recovered faunal remains from Area 751 suggest a diversified economy for the Greenwood phase occupants. While bison may have constituted the primary protein source, deer, elk, and canids are well represented in the sample and smaller animals and birds are also present. Unfortunately, little is known about the vegetal food preferences of the Greenwood phase inhabitants. The inferred subsistence pattern, based primarily on faunal evidence, accords fairly well with the "...simple creek-valley hunting-gathering economy" envisioned by Wedel for the Plains Woodland (1959:626) and with Caldwell's (1958, 1962) concept of Primary Forest Efficiency. Basically, the inferred subsistence economy for the Greenwood phase inhabitants at the Cow-Killer site is a low risk economic strategy with considerable diversification evident. This certainly contrasts markedly with at least some other prehistoric and historic subsistence patterns among Plains groups, where economies are designed to exploit either single resources (bison hunting) or dual resources (bison hunting and corn, bean, squash horticulture). Historically, these single resource/dual resource strategies are exemplified by the Cheyenne and Pawnee, respectively, in Kansas.

Stratigraphy:

The stratigraphy of deposits within Area 751 was complex and somewhat difficult to comprehend. In terms of the gross stratigraphy of this area, it was evident that at least five distinct soil zones were contained within the 10.5 ft of vertical deposits which were investigated. At least two, and possibly three, cultural zones were present within the 10.5 ft thick vertical deposit. The elevation of the central dike, after initial construction of the two stabilization ponds, was 974 ft above mean sea level. The first 1 ft of deposit on the central dike and, in fact, surrounding the two ponds on all sides, was fill dirt built up by the contractor to increase the height of the two ponds. This soil was evidently obtained from areas

adjacent to the ponds by the simple expedient of pushing the fill up onto the pond's edges, or by using the removed pond fill to create the needed elevation. Thus, the few isolated artifacts observed on the dike top are of uncertain derivation.

A 1 ft thick dark humic zone underlay the disturbed deposit. This was obviously the original top soil that was present prior to the stabilization pond construction. It too had been somewhat disturbed by construction equipment, although it was primarily in its original location. This soil zone was tested by placing two 5 by 25 ft rectangular test excavations into it (X units 186 and 187). Occasional isolated artifacts and flecks of burned earth and charcoal were noted in the fill removed from these tests. The scanty diagnostic materials recovered from this zone suggested that it was a cultural level attributable to the Middle Ceramic period and, more specifically, to the Pomona focus.

The third soil zone encountered ranged from 1.5 to 2.0 ft thick and was composed of a light brown silt or silty clay which was devoid of cultural materials. In the central dike area this zone was removed with power equipment at the time of our tests to facilitate the investigations of the next zone.

The fourth zone encountered was the 2.0 ft thick zone of dark humic soil which contained abundant evidence of the Plains Woodland component at the Cow-Killer site. This primary zone of cultural debris was slightly less than 2.0 ft in thickness in Excavations A and B on the central dike. Measurement of the actual elevation of this zone, at various locations in Area 751, indicated that it ranged from 967.8 ft above M.S.L. to 970.5 ft above M.S.L. This cultural zone was noted and measured both in the central dike area and along nearly the entire north slope of the primary and secondary cells of the stabilization ponds. It was noted that the strata dipped about 1.0 ft within the 200 plus foot vertical section revealed in our tests. The dip was to the east. That is, the 2.0 ft thick cultural zone was buried 1.0 ft deeper at the eastern end of the stabilization ponds than it was at the west.

This important cultural zone within Area 751 had a very complex internal stratigraphy. The entire 2.0 ft of deposit contained fairly abundant cultural evidence which consisted of structural features (i.e., postmolds, pits, hearths, basins, trash deposits) and artifacts (potsherds, chipped stone tools and debitage, bone, shell, and miscellaneous stone), as well as a general matrix of cultural mix (charcoal and burned earth flecks) scattered throughout the dark humic soil. That there was a complex internal stratigraphy to this zone was obvious to the investigators. Unfortunately, the uniform dark humic

soil which comprised this zone was usually not amenable to separation into distinct cultural levels. In a few instances, internal stratigraphy could be observed, and was so noted. The most obvious example of this was the finding of what appeared to be elements of a fallen roof or wall from a structure that were encountered high up in the cultural level in Excavation A on the central dike (Plate 45, Figure 20).

The primary method used to separate cultural materials within the 2.0 ft thick zone was necessarily based on the vertical provenience of structural features and featured artifacts. Putting aside the complexity of the eastern declension of this cultural level, and assuming that the 2.0 ft thick zone in Excavations A and B were on a more or less level surface (there would be less than 0.25 ft of slope occurring from the west part of Excavation A to the eastern part of Excavation B), we note considerable complexity of vertical stratigraphy by plotting all features by one half foot thick levels.

As Figure 21 illustrates, one structural feature (Hearth 1), a projectile point, a biface and a piece of burned limestone were noted or recovered from the first half foot level, 969.5 to 970 ft above M.S.L. in Excavations A and B. Hearth 1 was a basin-shaped hearth that was filled with ash, charcoal and burned bone. Its orifice was obvious and was marked both by the above materials contained within it and by the circular layer of burned earth which formed its outer limit. The second half foot level, 969 to 969.5 ft above M.S.L., contained 17 artifacts (projectile points, bifaces, unifaces, modified flakes and potsherds), but only a single structural feature, Feature 163, a trash or midden area of burned and unburned limestone rocks (Figure 22).

The third half foot level in Excavation A and B (968.5 to 969 above M.S.L.), contained 16 artifacts (projectile points, bifaces, a drill, a chert core, an antler tine, sherds and bone), five trash or midden areas (Features 228, 180, 181, 175, 223/258), two hearth orifices (Hearths 2 and 3), and three basin orifices (Basins 2, 5, and 7) (Figure 23). The fourth plotted half foot level, 968 to 968.5 ft above M.S.L., contained nine featured artifacts (projectile points, bifaces, unifaces, a fired clay object, a grinding slab and bone), seven postmold orifices, two basin orifices (Basins 3 and 4), one pit orifice (Pit 1, Feature 312) and two trash complexes (Features 269 and 296) (Figure 24). The fifth half foot level, 967.5 to 968 ft above M.S.L., contained two bifaces, two postmold orifices, a bone complex (Feature 315) and the orifice of Basin 6 (Figure 25). It seems obvious that the 2.0 ft cultural zone described above reflects either long term or successive habitation of this particular location by the same or closely related peoples.

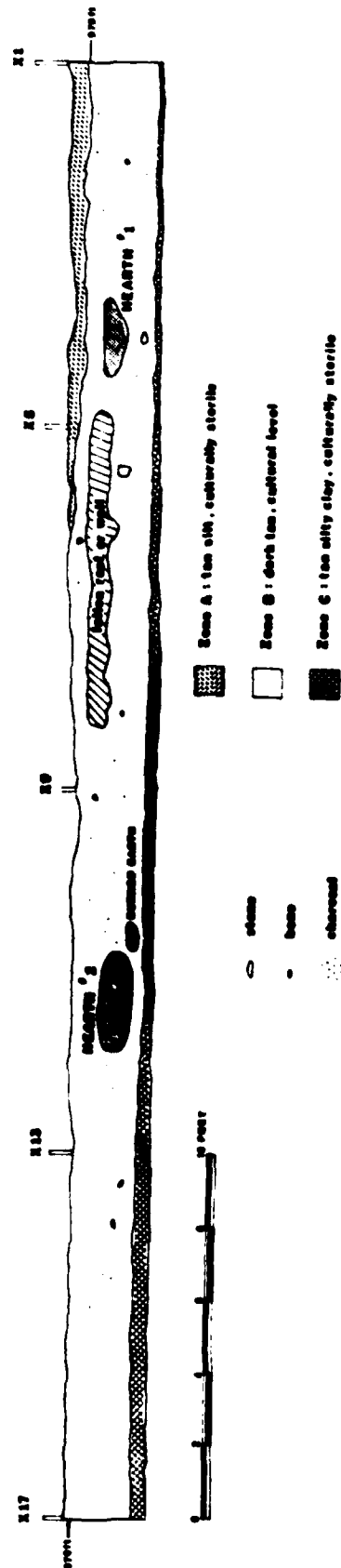


FIGURE 20: 140S347, Area 751, Vertical profile of west wall of X units 1, 5, 9 and 13



PLATE 45: 14OS347, Area 751, Excavation A, west wall of
X unit 5, showing charcoal, daub and burned earth lense

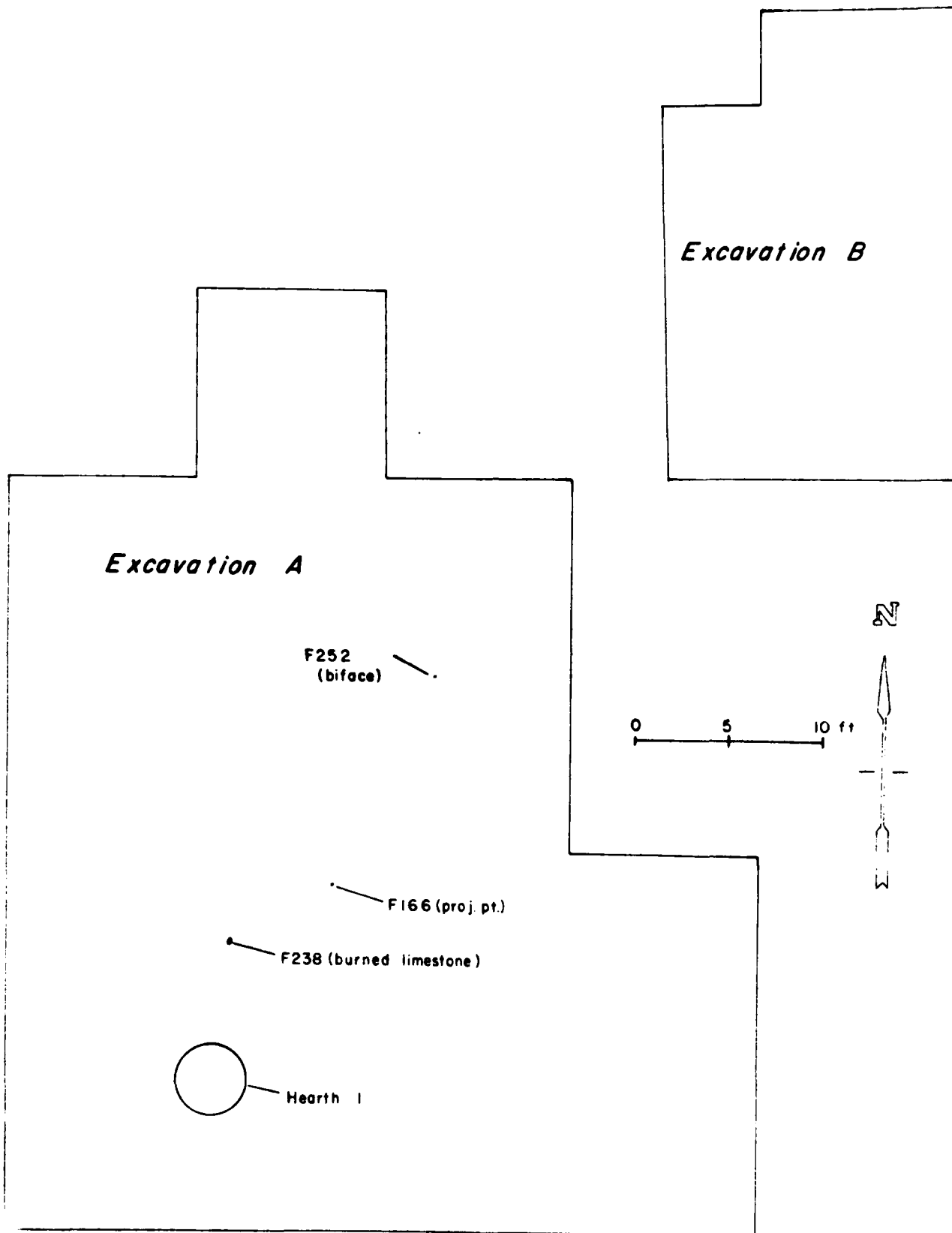


FIGURE 21: 140S347, Area 751, Excavations A and B, horizontal distribution of features, elevation 969.5 to 970 ft above M.S.L.

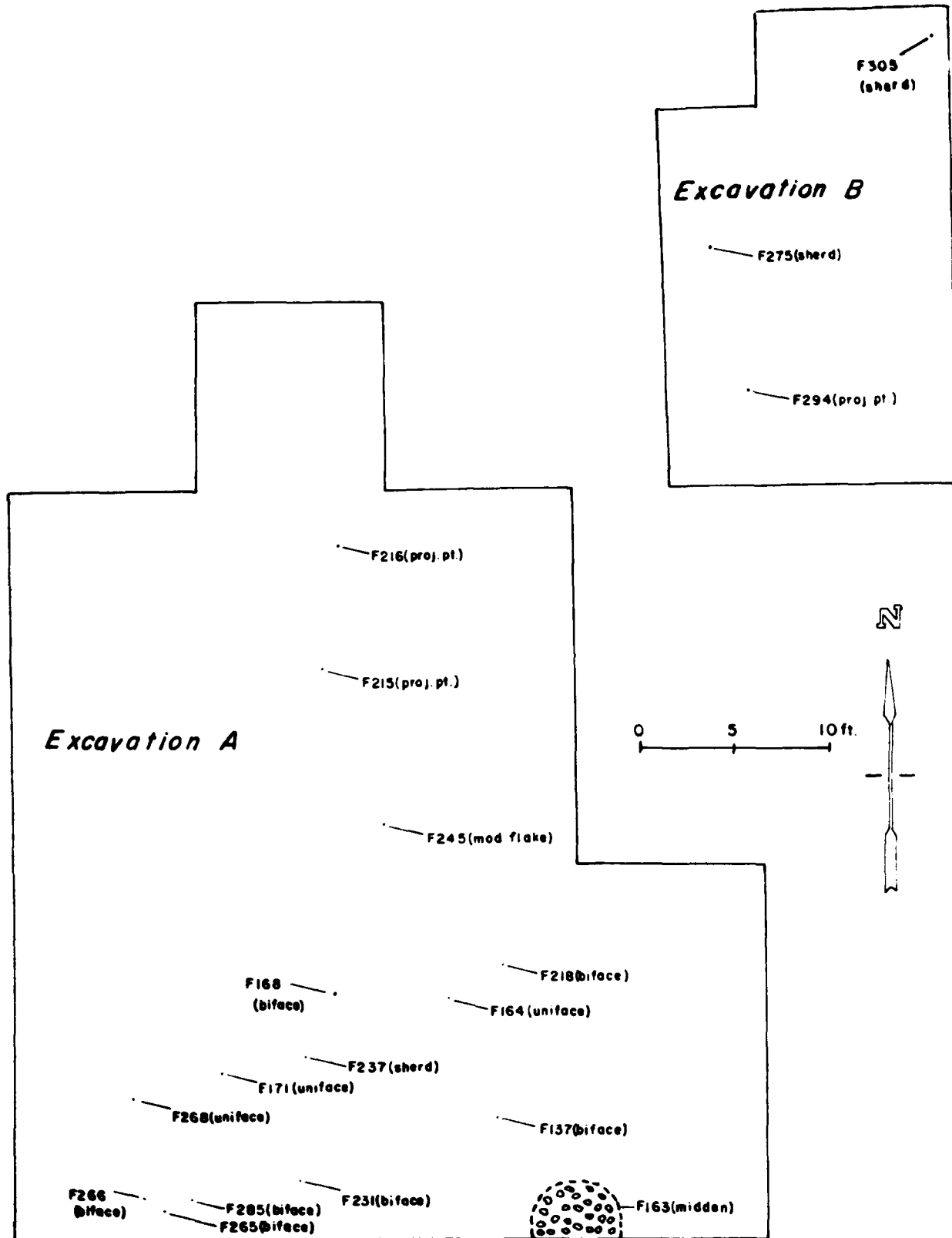


FIGURE 22: 140S347, Area 751, Excavations A and B, horizontal distribution of features, elevation 969 to 969.5 ft above M.S.L.

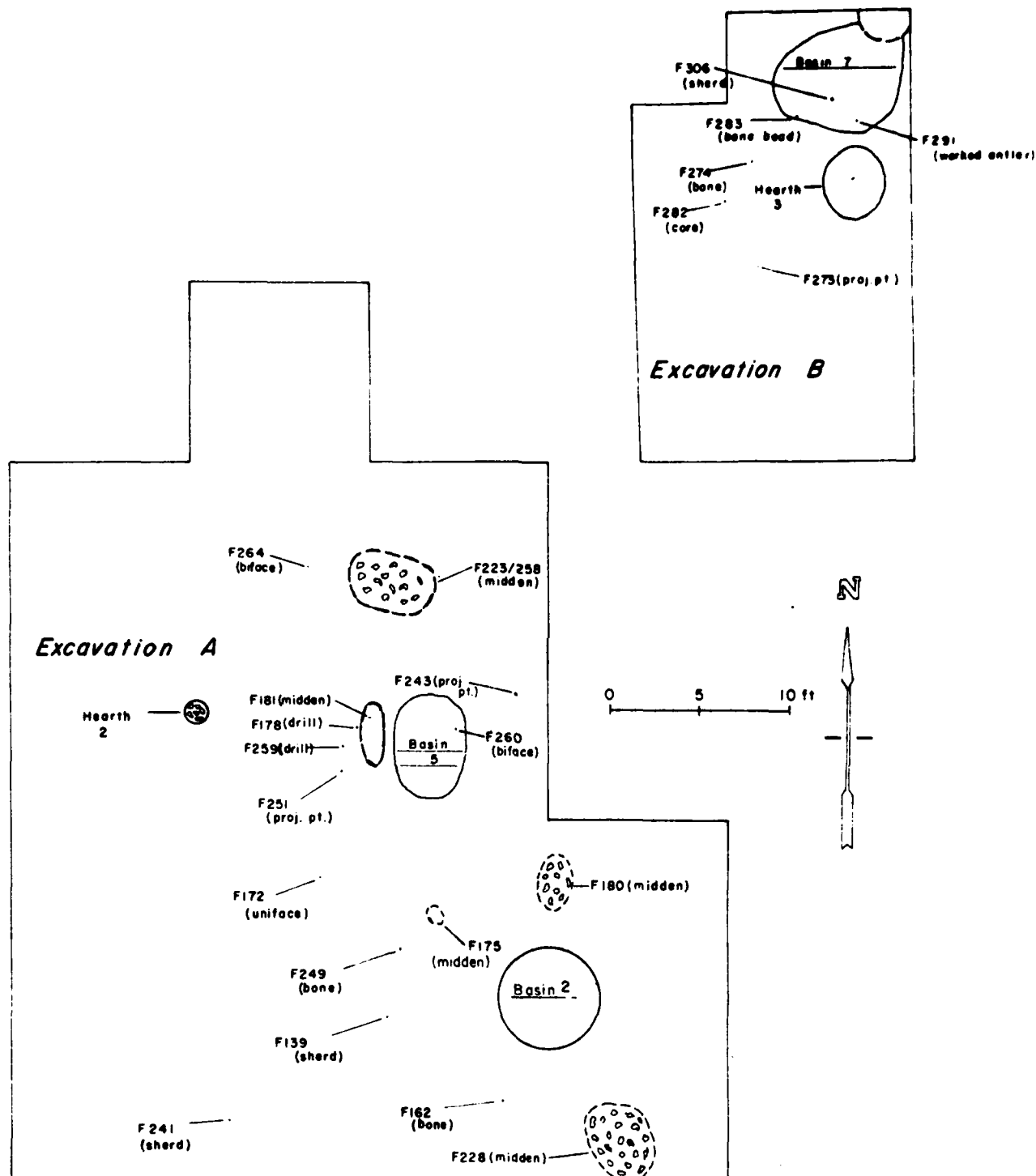


FIGURE 23: 14OS347, Area 751, Excavations A and B, horizontal distribution of features, elevation 968.5 to 969 ft above M.S.L.

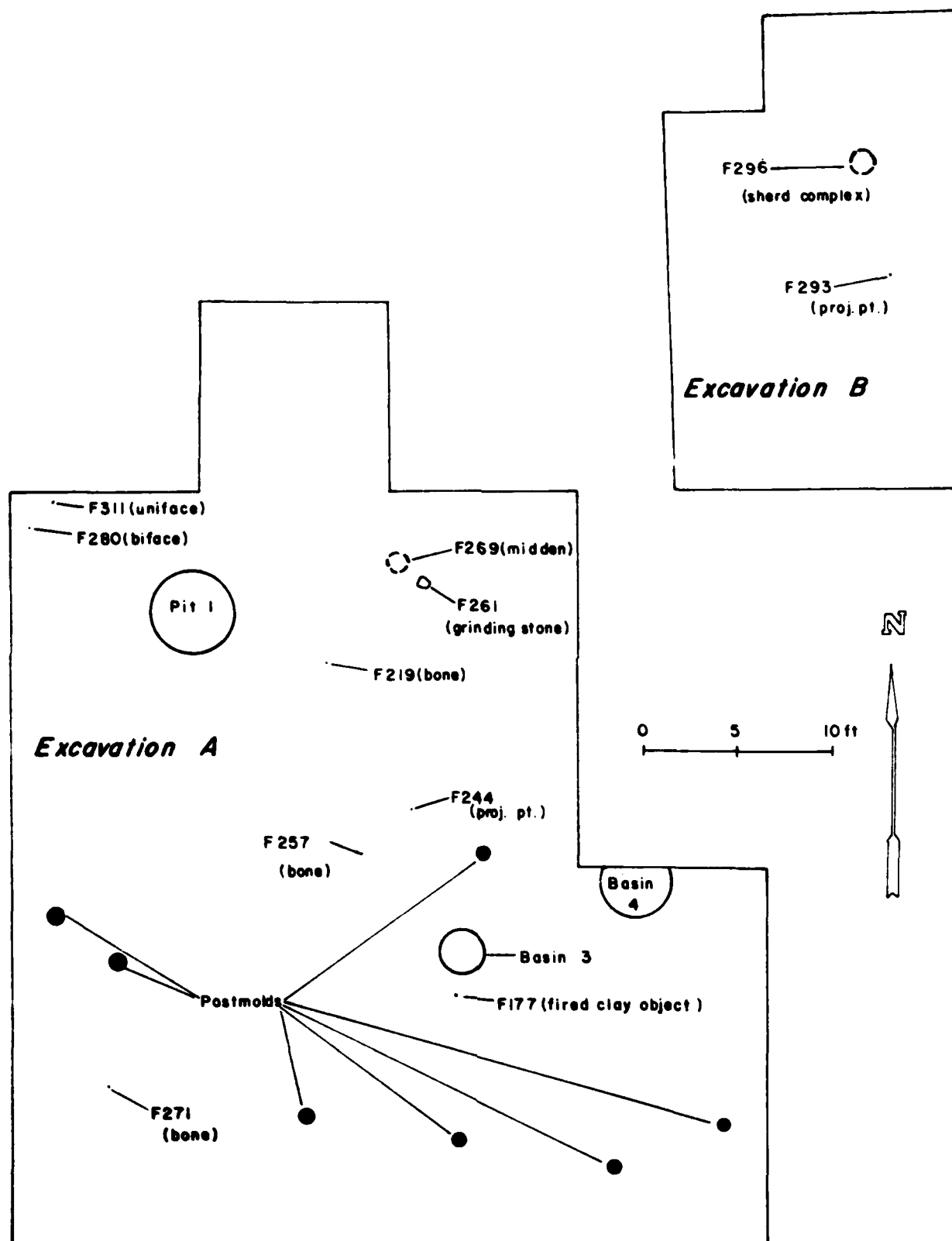


FIGURE 24: 14OS347, Area 751, Excavations A and B, horizontal distribution of features, elevation 968 to 968.5 ft above M.S.L.

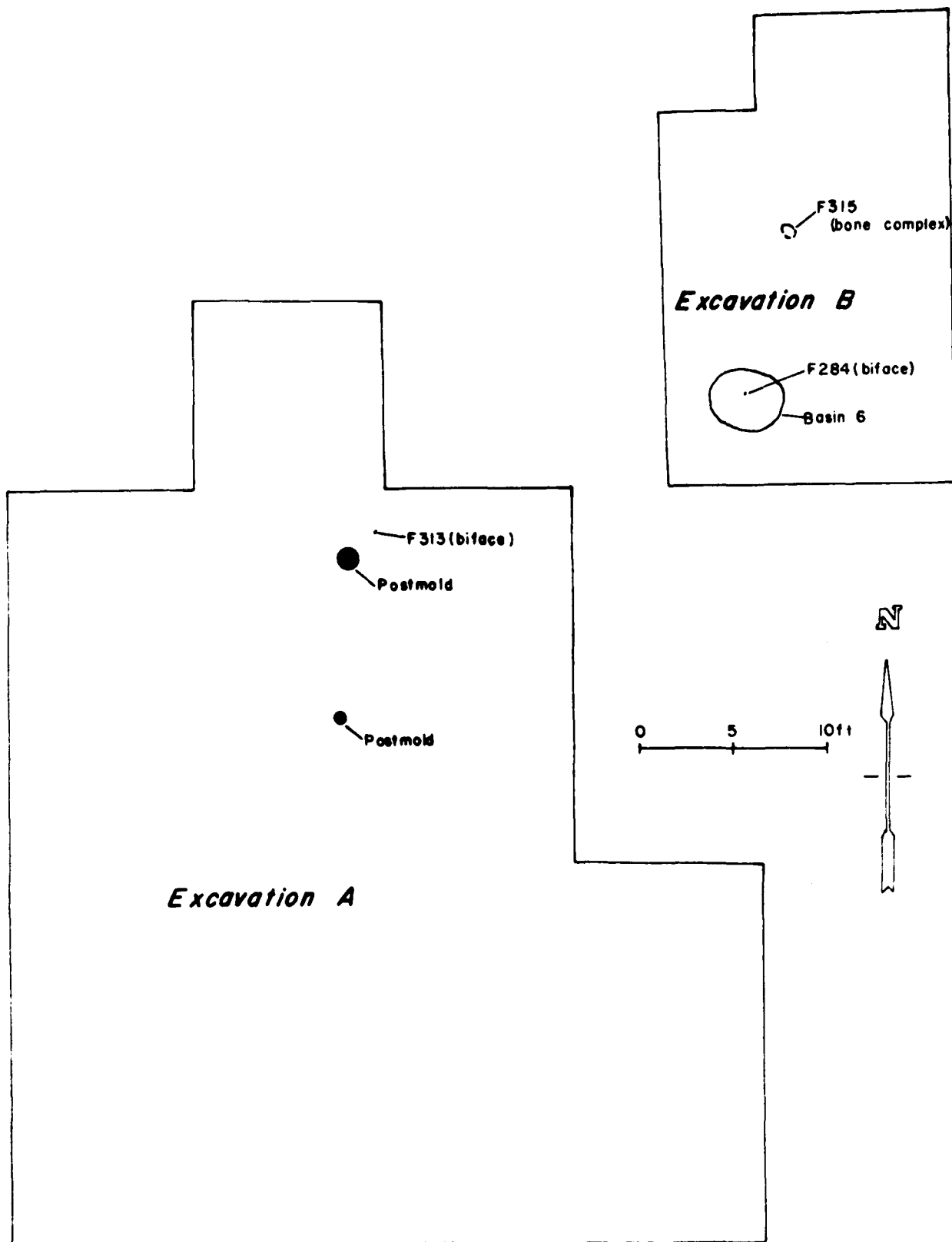


FIGURE 25: 14OS347, Area 751, Excavations A and B, horizontal distribution of features, elevation 967.5 to 968 ft above M.S.L.

Underlying the dark humic zone which contained the primary evidence for the Plains Woodland occupation at the Cow-Killer site was a light brown silty clay which extended down for an undetermined depth. A one inch diameter Oakfield soil core probe was utilized in the deepest part of the primary (western) cell to test the thickness of this zone. We were thus able to establish that this last encountered zone extended down at least 2.5 ft below the center of the primary cell to an actual elevation of 963.5 ft above M.S.L. In the last half foot of this deposit, 963.5 to 964 ft above M.S.L., a few flecks of burned earth and charcoal were noted in three of the probe samples; suggesting the presence of still another deeply buried cultural zone.

The remaining foot of deposit in Area 751, as indicated on Figure 4, is accounted for by the cultural deposits occurring in the 5 by 10 ft test excavations that were placed on the north slopes of the primary and secondary cells of the stabilization ponds. In these areas, the cultural deposit was approximately 2.0 ft thick, but the general level, due to the previously described slope of the deposit, was at a slightly different elevation.

Chronology:

Three samples of wood charcoal from the Plains Woodland level in Area 751 at the Cow-Killer site have been submitted to the Teledyne Isotopes Radiocarbon Laboratory in Westwood, New Jersey. It is suspected that the resultant dates will fall within the range of A.D. 500 to A.D. 1000, or perhaps slightly later.

Summary and Conclusions:

Area 751 at the Cow-Killer site was identified during monitoring of a Corps of Engineers stabilization pond construction project in late July of 1974. Materials collected from the disturbed construction cut indicated that this area contained a partially intact and potentially significant cultural deposit attributable to the Greenwood phase of the Plains Woodland. Structural evidence consisting of burned daub was noted and was considered significant in view of the relative lack of information available about Greenwood phase structures. Fairly abundant animal bone was also noted and this was considered significant because most previously investigated Plains Woodland sites in eastern Kansas are sparsely represented by faunal remains.

During the period from April 7 to May 16, 1975, an archeological field party from the Kansas State Historical Society conducted salvage excavations in Area 751 under a purchase order from the Kansas City District, Corps of Engineers. Most of the excavation was confined to the relatively undisturbed central dike area which separated the primary and secondary cells of the stabilization ponds. In this area, seventeen 10 by 10 ft squares and three 5 by 10 ft squares were excavated to an average depth of slightly greater than 2 ft. Two additional 5 by 25 ft squares were placed at a higher elevation in the same area and excavated to an average depth of 1 ft. Six additional 5 by 10 ft test excavations were placed in the sloping sides of the primary and secondary cells and excavated to a depth in excess of 2 ft. A total of 2,400 sq. ft of Area 751 was thus investigated with a volume of 5,525 cu. ft of fill excavated.

The complex stratigraphy of Area 751 contained a 2 ft thick cultural zone attributable to the Greenwood phase occupation as well as a higher and more sparsely represented zone that is evidently attributable to a Pomona focus occupation during the Middle Ceramic period. A third and more deeply buried component may underlie the Greenwood phase occupation by some 4 ft. The 2 ft thick Greenwood phase component in Area 751 was by far the best represented of the cultural components and was the focus of the 1975 investigations.

The Greenwood phase component in Area 751 contained evidence of at least one, and almost certainly two, structures. The first of these, as shown in Figure 19 and Plate 45, was indicated by a possible fallen roof or wall, consisting of a lense of charcoal, burned earth and daub, that occurred high up in the southwest part of Excavation A on the central dike. A hearth, Hearth 1, was probably associated with the fallen

debris as it occurred at approximately the same elevation and was located slightly to the south of the fallen debris. Unfortunately, the very dark and homogeneous humic soil which underlay this debris made it impossible to locate any postmolds which would presumably have been affiliated with the structure. This complex is interpreted to be the remains of a partially daub covered structure that represents the terminus of the Greenwood phase occupation.

A second set of structural elements, consisting of nine identified postmold stains, was identified in the floor of Excavation A immediately after the dark humic soil had been removed. These features were all identified at approximately the same elevation and all were similar in size and fill composition. It seems likely that the nine postmolds were elements of a fairly large structure, possibly oval or circular in shape and with some internal posts. The actual floor of this structure was certainly at a higher elevation than at that point where the postmolds were defined. However, the fallen roof or wall elements from the possible structure mentioned in the preceding paragraph were evidently not associated with this postmold pattern. This conclusion is based on the interpretation of the vertical and horizontal placement of other structural elements in Excavation A. Specifically, Hearth 1, which was almost certainly associated with the fallen roof or wall elements that occurred high up in the Greenwood phase deposit, is situated in the projected wall, in a line between two of the more deeply buried postmolds. Since this is not a feasible alternative for hearth placement within a structure, we conclude that two different structures are represented. The occurrence of additional burned daub fragments in basins, trash/midden areas, and in the general fill of Excavation A, suggests that the more deeply buried structure was also at least partially daub covered.

Other structural elements discovered in Area 751 included hearths, pits, basins and trash deposits. Two hearths were identified in Excavation A at slightly different elevations. Hearth 1 was a basin-shaped hearth that was filled with charcoal, ash, burned earth and bone fragments. Hearth 2 was located slightly deeper in the deposit and it was a stone lined hearth of small size. The third hearth in Area 751 conformed in general shape and size to Hearth 1. Hearth 3, however, was identified in Excavation B. A single mussel shell roasting pit of small size was identified in Area 751 outside of the central dike area. This interesting feature was located during testing of the north slope of the secondary (eastern) cell and basically it consisted of a small, 1 ft diameter, straight sided pit which was filled with a layer of mussel shells and, underneath this, a layer of charcoal. One deep and slightly bell-shaped storage pit was encountered in Area 751. This feature was clearly

identified in horizontal section in the floor of Excavation A and, when excavated the feature was found to contain culturally mixed soil as well as the articulated skeleton of an immature bobcat.

A total of eight shallow basins were recognized in Area 751. Their orifices were noted at different elevations, suggesting long term site occupation. These features typically were shallow trash-filled pits with inwardly sloping walls. Five of the shallow basins were found within the limits of Excavation A, two in Excavation B, and the remaining example was encountered during testing in the north slope of the secondary (eastern) cell. The function of these basins as trash receptacles is inferred from the cultural debris contained within them. It is likely, however, that this was merely the terminal function of the basins and that they originally had other functions. Some of the more carefully prepared basins, such as Basin 5 and Basin 6, may have been storage areas within the site. Other, more irregularly prepared basins, such as Basin 7, may originally have been borrow pits where earth was obtained to use in plastering the walls of structures. Deposits of discarded limestone, sandstone, bone, lithic debitage and potsherds were a common occurrence in Area 751. Thirteen such deposits were encountered in Area 751 and 11 of these were identified within the limits of Excavations A and B. These trash areas lacked evidence of placement in intentionally prepared pits and basins. They ranged in character from small deposits of related potsherds and stone debitage to larger midden areas that yielded a mix of sherds, stone, bone, burned earth, daub, etc. Their identification at several different elevations lends further support to the supposition that Area 751 was occupied, or reoccupied at short intervals, for a long period of time.

Artifacts and ecofacts recovered from Area 751 included potsherds, daub, burned earth, mud dauber's nests, chipped and ground stone tools and associated debris, charcoal, worked bone and antler, a very few seeds and nut shells, abundant bone, and some shell.

Ceramic artifacts recovered from Area 751 included sherds and sherd sections from a large number of vessels, a few fragments of tempered and fired clay which may be pipe fragments, and a few unidentified fired clay objects. Four somewhat distinct varieties or categories of potsherds were recognized on the basis of temper, exterior surface treatment, and vessel form. Category A sherds were typically tempered with burned and crushed particles of limestone and they had an external surface finish which ranged from cord marked to smoothed to polished.

Vessel shape was inferred to be conoidal with straight or bulging sides and little or no neck construction. Category B sherds had the same basic vessel shape as Category A sherds, but temper consisted of sparse particles of indurated clay. Exteriors were typically smoothed or smoothed with a slip. Category C vessels had sparse to abundant indurated clay temper, cord marked exterior surfaces, and a globular vessel shape with constricted necks, everted or straight rims that were simple and unthickened. Category D sherds were of indeterminate shape, were either cord marked or smoothed on the exterior surfaces, and had either shell temper or sand and/or finely crushed grit temper.

Comparison of the ceramic sample from Area 751 with other Early and Middle Ceramic period defined types and wares revealed that Category A and B sherds from the Cow-Killer site had their closest affiliation with the Verdigris type of the Greenwood phase (Calabrese 1967, Jones and Witty 1980). Category C sherds are most similar to the Greenwood type (Calabrese 1967) and have general similarities to Pomona ware of the Middle Ceramic period (Wilmeth 1970). An interesting feature of this ceramic sample is the apparent co-occurrence of a basically Plains Woodland ceramic type (Verdigris type) with a type (Greenwood type) which seems more closely aligned to the Middle Ceramic period. As indicated in the discussion of Area 751 ceramics in this text, this co-occurrence has been noted in at least three other Greenwood phase sites in eastern Kansas.

Chipped stone tools and associated debitage were not found in great abundance in Area 751. Nevertheless, the recovered specimens proved interesting for the evidence that they provided about the flintknapping technology of the Greenwood phase peoples as well as for the inferred evidence for subsistence activities and crafts. Flintknapping debitage recovered from Area 751 included cores, flakes and shatter; while traditional artifact categories represented included projectile points, drills, thin bifaces (cutting implements probably), thick bifaces (chopping tools), unifaces (possible scraping and cutting tools), and utilized and modified flakes. Bifacial implements were also represented by possible blanks and preforms and the general lithic inventory also included possible burins. The recovered debitage from Area 751 represented essentially all stages of the silicate fracturing process and discernible categories of recovered material include unmodified potential cores, cores, partially prepared bifaces and unifaces, primary decortication flakes, secondary decortication flakes, core reduction flakes, biface thinning flakes, internal thinning flakes, small thinning flakes and shatter. Study of the lithic debitage reveals that all stages of the flintknapping process were performed at the site and that the preferred material (or at least the most chosen material) was a rather uneven quality chert of local river

cobble derivation. Flintknapping techniques exhibited in Area 751 were somewhat rudimentary. Percussion and pressure flaking techniques were evidently employed in flake preparation from multidirectional, irregularly shaped, river cobble cores. Additionally, biface preparation was well represented. The debitage category did not contain evidence of sophisticated core preparation or blade making as is sometimes exhibited at other Early Ceramic period sites in Kansas. Extraneous gray and white chert flakes were noted in the debitage categories in small numbers and also in the artifact categories and these may reflect the usage of nonlocal silicates for some implements. While thermal alteration of some of the silicates was noted, the altered pieces often contained pot lid or crenated fractures, suggesting that this was unintentional thermal alteration rather than heat treatment.

Projectile points recovered from Area 751 included large and medium size stemmed varieties, small corner notched projectile points, a portion of a small plain triangular point, and one lanceolate point. The large and small stemmed and corner notched projectile points are readily assignable to the Early Ceramic period. The large lanceolate point has a slightly tapered basal element and, in general, this point is reminiscent of Archaic cultural manifestations. The plain triangular projectile point is characteristic of the Middle Ceramic period although such specimens have been recovered from other Early Ceramic period components in Kansas (Rowlison 1980). Furthermore, a plain triangle is the logical preform shape for production of such types as the small corner notched points. Other notable chipped stone artifacts recovered from Area 751 are a carefully made drill that has an expanding base and a thick biface which has two opposite notches. This latter specimen has been classified as a spokeshave by the author on the basis of its shape and extant use wear marks.

Recovered pecked and ground stone tools from Area 751 were minimal. One nearly complete sandstone grinding stone and sections of four, or possibly five, other similar slabs were recovered as well as a portion of a sandstone muller. Awl sharpeners and biface abraders were represented by one specimen of each. A single example of a hammerstone, presumably for flintknapping, was identified, and several pieces of recovered hematite and limonite may have been used for pigment. Unworked limestone, both burned and unburned, was found throughout the Greenwood phase component and several fairly large clusters were noted.

Worked bone and antler from Area 751 included both tools and ornaments. Two possible antler pressure flaking tools were identified and two bone awls, presumably for hide working, were

recovered. An unusual small cylinder of antler was found in Basin 6. While a function for this object could not be determined, it may have been either an intermediate punch for flintknapping or a smoothing tool for pottery making. A section of a pierced deer phalanx was recovered, but no estimate of its use can be made. Eight complete or fragmentary tubular bone beads were found in Area 751. Three of these specimens are somewhat long in relation to their diameter while the remaining five beads are quite short and typically have a circumferential shallow groove incised into them.

Large amounts of burned daub were recovered throughout Area 751. These materials, and two mud dauber's nests, attest to the fact that wattle and daub covered structures of some permanence were once present in Area 751 of the Cow-Killer site. The burned daub fragments contain both grass impressions (ranging in diameter from less than 1 mm to 3 mm) and pole impressions (ranging in diameter from 15 mm to in excess of 40 mm).

Faunal remains were abundant in Area 751 and fairly well preserved. In general, these represent the residue of butchering activities and consist in large part of bone fragments of white tailed deer, with some bison and elk also represented. Smaller animals are represented by several species of *Canidae*, including coyote, domestic dog and wolf; raccoon; beaver; eastern cottontail and jackrabbit; bobcat; mink; and numerous smaller mammals. An interesting comparison can be drawn between bone parts represented for white tailed deer and bison in Area 751. While virtually all parts of white tailed deer were present in the sample (though usually in a broken state), many bison parts were missing, including skulls, scapula, front legs, and innominate bones. Both adult and subadult deer and bison were present in the Area 751 sample, though far fewer subadult bones were present. Interesting for their absence were bison scapulae. Bison scapulae, both modified and unmodified, are of common occurrence on later Middle Ceramic period sites where they are often modified to form hoes and other digging tools. Their total absence from the Area 751 faunal inventory, and the general small representation of bison bones in this inventory, may provide important clues to be used in reconstructing the subsistence pattern of the Greenwood phase peoples. Birds are somewhat scantily represented in the osteological remains although bones of several species, including prairie chicken and wild turkey, were recognized. The absence of identified waterfowl is interesting in terms of subsistence pattern as is the lack of fish. Turtle and mussel shell remains, on the other hand, were relatively abundant. We might note, in this context,

that in Area 741 of the Cow-Killer site (the Archaic component) fish were present in the faunal inventory, but mussels were absent. The finding of an almost complete skeleton of an immature bobcat in Pit 1 in Area 751 suggests that this animal was not considered a food source.

Remains of flora were very sparse in Area 751 and consisted of fairly abundant wood charcoal, nut shells (at least some are walnut) and two separate finds of a very few small, charred and much fragmented seeds. No cultigens were noted in the vegetal sample, but this is not surprising in light of the fact that so few floral remains were recovered. Nevertheless, the absence of *Zea mays* and other domesticated plant species accords well with the general absence of gardening tools from the area.

In summary, while Area 751 may have contained evidence of three distinct cultural components, only one of these, the 2 ft thick Greenwood phase component, had sufficient material evidence preserved or accessible to warrant archeological salvage. Fairly extensive investigation of this component during five weeks in the spring of 1975 revealed it to be a stratified component with evidence for at least one, and probably two, domiciliary structures. The component is interpreted to be a stratified habitation level. The range of activities reflected in the material remains for this component are considerable and, minimally, include the following: flintknapping; ground and pecked stone tool production and utilization; pottery making; food collecting and preparation; timber cutting; house building; digging operations; collecting of primarily local mineral, faunal and floral resources; bone and possibly woodworking; and the disposal of refuse.

The investigations conducted in Area 751 at the Cow-Killer site have added to our understanding of the Greenwood phase and, more generally to an understanding of the Plains Woodland in the Central Plains. The basic cultural pattern exhibited by the Greenwood phase people at this site is one that has been familiar to archeologists in the Central Plains for some time. As Wedel has stated, most Plains Woodland sites in the Central Plains "...suggest a simple creek-valley hunting-gathering economy, with relatively small population aggregates" (1959:626). In terms of subsistence, Wedel has noted the presence of cultigens at some Plains Woodland sites although the predominant subsistence pattern appears to be hunting and gathering with woodland margin mammals such as deer and elk predominating over bison in the refuge deposits (Wedel 1959:626). All of the subsistence information recovered from Area 751 supports this creek-valley hunting-gathering economy envisaged by Wedel. Furthermore, heavy dependence on white tailed deer was amply supported by the Cow-Killer data, although, as previously noted, bison may have been the primary protein source for the Greenwood phase inhabitants.

The deep and stratified deposit revealed for the Greenwood phase component in Area 751 is considered somewhat unusual for Plains Woodland sites in Kansas. Investigated sites of the Grasshopper Falls phase, for instance, were typically characterized by very shallow, single occupations which spanned a relatively short period of time (Reynolds 1979). Deeply buried and stratified Plains Woodland components have, however, been noted in the Central Plains; most notably, at the type site for the Valley focus, the VY-1 site in Valley county, Nebraska (Hill and Kivett 1940). At the VY-1 site, the Valley focus component had an occupation zone which ranged from 16 to 40 inches thick (Hill and Kivett 1940:147-193). Data recovered from Area 751 proved to be inconclusive in terms of year around or seasonal reoccupation by the Greenwood phase peoples.

Structural information as to house types of the Greenwood phase was present in Area 751 but, unfortunately, it was in a disturbed state due to construction of the two stabilization ponds. Nevertheless, our investigations revealed the presence of structures which were at least partially covered with wattle and daub and which apparently had perimeters demarcated by large and widely spaced posts. Oval or circular structures of some size are suggested. Unfortunately, none of the Greenwood phase sites excavated so far has yielded a complete post pattern although incomplete post patterns have been noted for the Curry site (Calabrese 1967) and the Two Dog site (Jones and Witty 1980). House forms have been indicated for several other Plains Woodland complexes (Keith focus, Valley focus, Grasshopper Falls phase) as well as for the Cuesta phase (Reynolds 1979 and Marshall 1972). Grasshopper Falls phase structures, although smaller in size, share certain characteristics with the Greenwood phase structures; notably oval to circular shapes and partial wattle and daub covering (Reynolds 1979). Cuesta phase structures, while they have not yielded evidence of wattle and daub construction, exhibit deep and widely spaced perimeter posts with some interior posts and these are characteristics that we have noted for the incomplete post pattern discovered in Area 751.

As has been indicated earlier, Plains Woodland ceramics share some overall traits of vessel shape and size. The most common vessel shape appears to be medium to large sized conical based pots with straight to somewhat bulging sides and simple or slightly thickened rims. The wares tend to be fairly coarsely tempered and vessel surfaces are often cord marked or sometimes smoothed. Decoration is usually absent and, when present, is confined to necks and rims. These are basically functional utilitarian wares without noticeable elaboration. The ceramic sample from the Greenwood phase component at the Cow-Killer site yielded sherds that fit

this basic description and these have been attributed in this report to an earlier defined Plains Woodland ceramic type, the Verdigris type (Calabrese 1967 and Jones and Witty 1980). The presence of slip on some external surfaces of the Verdigris sample from the Area 751 investigations is considered significant as it indicates a more complicated finishing process for the ceramics than has previously been noted on Plains Woodland ceramics. Additionally, the presence of another ceramic type, Greenwood type, was noted in the Area 751 sample. This latter type differs in terms of overall shape from the generalized Plains Woodland pattern, although the type does appear to be a recurrent type at Greenwood phase sites. The Greenwood type sherds represent globular vessels with somewhat constricted necks and straight to outwardly flaring rims. Decoration is absent or minimal although vessel surfaces are usually overall cord marked. As has been noted by several investigators (Calabrese 1967, Jones and Witty 1980, Wood 1977, Reynolds 1979), the Greenwood type shares many characteristics with Pomona ware of the Pomona focus of the Middle Ceramic period. The co-occurrence of ceramic types that are representative of both the Early and Middle Ceramic periods is interesting and certainly lends support to Witty's supposition that the Pomona focus, and perhaps other Middle Ceramic period complexes, are an outgrowth of Plains Woodland peoples who temporally preceded them (Witty 1978:62).

The primary dating evidence for the Plains Woodland sites in Kansas comes from radiocarbon determinations, stratigraphy, and cross dating of Kansas materials with documented finds in other areas. Radiocarbon dates for the Plains Woodland, though few in number, suggest a general placement of this manifestation into the period from A.D. 1 to A.D. 1000 (Reynolds 1979:99-102). The stratigraphic position of the Greenwood phase component at the Cow-Killer site was fairly clear as Archaic levels were discovered several feet below the Greenwood phase materials and Pomona focus materials were discovered stratigraphically higher. The absolute chronological position of the Greenwood phase component will hopefully become more clear when the submitted radiocarbon determinations are available.

The archeological investigation of Area 751 was completed in late spring of 1975. Sometime afterwards the Corps of Engineers had the excavation areas backfilled and proceeded with the stabilization pond construction. This sewage facility has now been operational for several years.

SUMMARY

The preceding report has presented the findings from investigations conducted at archeological site 140S347, the Cow-Killer site, by the Archeology Department of the Kansas State Historical Society. This site is an important three component prehistoric archeological site that was discovered during removal of fill from a borrow area in conjunction with construction of new highway U.S. 75. The site is located on the left or north side of the Marais des Cygnes river between the old and new alignment of highway U.S. 75 on the downstream side of the Melvern dam. The site complex is part of an old and low terrace remnant of the Marais des Cygnes river. Steep limestone bluffs are located immediately north of the site and a cutoff meander of the Marais des Cygnes forms the western boundary. The present river channel, which has been straightened, forms the southern boundary and old highway U.S. 75 forms the eastern boundary.

Cultural materials attributable to at least three temporally distinct prehistoric cultures have been identified in the site area. The earliest cultural level uncovered at the site is an Archaic period component which was located at an actual elevation ranging from approximately 960.5 to 964 ft above mean sea level. Test excavations performed by a Kansas State Historical Society crew in Area 741 of the site revealed the presence of a 1.5 ft thick stratified Archaic cultural level which yielded stone lined hearths, basin-shaped and trash-filled pits, random posthole molds, chipped and ground stone tools, animal bone, a very few charred seeds, charcoal and burned earth as well as additional stone debris. On the basis of distinctive chipped stone bifaces and points recovered from this zone, an affiliation with the Munkers Creek phase is suggested. A date of circa 3,000 B.C. is suggested on the basis of cross-dating.

The second oldest recognized cultural level, and the focus of the present report, was identified at an actual elevation ranging from approximately 967 to 970 ft above mean sea level in Area 751. This component is thought to represent a Greenwood phase occupation during the Early Ceramic period. Structural remains encountered in this 2 ft thick level included postmolds, pits, hearths, trash-filled basins and trash deposits. Artifacts recovered included potsherds, large to small stemmed projectile points, chipped stone bifaces and unifaces, flintknapping debitage, ground and pecked stone tools, worked and unworked bone and antler, mussel shell, charcoal, a few charred seeds and nut shells, unmodified stone, burned daub and burned earth. Cross-dating of diagnostic

artifacts with sites yielding similar materials from eastern Kansas suggests an age range from A.D. 500 to A.D. 1000.

Evidence for the presence of a third and more recent cultural component was found within the top soil of the site. Distinctive cord-roughened, clay tempered potsherds and small triangular arrowpoints recovered in this zone indicate a Middle Ceramic period occupation of the site sometime between A.D. 1000 and A.D. 1500 by a horticultural people who are identified as the Pomona focus.

Additional, and less thoroughly provenienced cultural materials were found in other areas of site 140S347. Scattered human skeletal remains were found in a disturbed context at the northwest edge of the site. These findings suggest that the site may have been a burial area as well as a habitation area during at least one of the three documented occupations.

The site has been subjected to considerable damage connected with highway and reservoir construction projects. The central portion of the site has been stripped of soil to a depth in excess of 10 ft in some areas. A substantial portion of all three of the cultural zones has been removed. A relatively extensive portion of the Archaic level has been preserved in the east central portion of the site (i.e., Area 741) and it is likely that additional Archaic remains are contained in an undisturbed context at the east, north, and west edges of the site. A portion of the Greenwood phase component is likely still present just outside of, and extending into, the stabilization pond area (Area 751). Additional Plains Woodland materials are preserved intact at the east, north, and west sides of the site although the preserved areas are not extensive. Meager evidence of the Pomona occupation may be present along the perimeter of the site where the top soil is still intact.

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APPENDIX A

SCOPE OF WORK

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Scope of Work
Analysis of Data From Cow-Killer Site, 140S347
Melvern Lake, Kansas
Marias des Cygnes River

Introduction

1. The Cow-Killer Site, a multicomponent site extending over several acres, is located in the SE 1/4, NE 1/4, NE 1/4, and NE 1/4, SE 1/4, NE 1/4 of Section 1, T18S, R15E. Three cultural units are associated with the site: Middle Ceramic (ca. 600-1000 b.p.); Early Ceramic, Greenwood Phase (ca. 1000-2000 b.p.); and Middle Archaic, Munkers Creek Phase (ca. 5000 b.p.). The site has been disturbed by a borrow pit and two stabilization ponds. The latter is the subject of a Memorandum of Agreement dated 22 May 1975, between the Corps of Engineers, Kansas State Historic Preservation Officer, and the Advisory Council on Historic Preservation.

2. During 1975 the first phase of the work required in the Memorandum was accomplished. This work consisted of excavating a portion of the archeological deposit in the stabilization ponds. A report entitled "Preliminary Report of Salvage Archeological Investigations at Site 140S347, Melvern Lake, Kansas" discusses the work and materials recovered. The second phase of the work required in the Memorandum calls for interpretation of the data and preparation of a report.

3. The work described in this document shall be performed by the Contractor. This study will complete a portion of the work required in the Memorandum of Agreement. Authorization for funding is Public Law 86-523 amended by P.L. 93-291.

Scope

1. This study shall provide for the interpretation of data as defined in the Study Approach. In addition, a report of findings shall be prepared following the requirements stated in the Schedule of Work.

2. The Contractor shall process and analyze the data recovered from the excavations in the stabilization ponds. The report of findings shall be directed toward interpretation of the structural elements and subsistence data recovered.

Study Approach

1. Problem orientation: Because of the paucity of data about the Greenwood Phase, Early Ceramic period (ca. 1000-2000 b.p.) all work shall be directed toward the following problem areas:

a. Temporal placement

b. Structural elements - post holes, pits, etc.

c. Subsistence - seasonality, scheduling, etc.

2. Study activities: The following activities shall be performed to accomplish the goals established in the previous section.

a. Submit carbonized material for radiometric dating.

b. Process and catalog all materials recovered.

c. Review all available literature about the Greenwood Phase, incorporate into the analysis, and present (postulation) the subsistence characteristics and structure characteristics of the Greenwood Phase.

d. Submit faunal and floral remains for analysis by appropriate specialists.

3. Staff and Facility Requirements

a. Project Director. The person in charge of this project must have the doctorate or an equivalent level of professional expertise in anthropology as evidenced by a publication record demonstrating experience in project formulation, execution, and technical monograph reporting.

b. Archeologist. The minimum formal qualifications for individuals practicing archeology as a profession are 1) a B.A. or B.Sc degree from an accredited college or university, 2) two years of graduate study with concentration in anthropology and specialization in archeology and 3) at least two seasons of field experience under the supervision of archeologists of recognized competence. Master's thesis or its equivalent in research and publications is highly recommended, as is the Ph.D. degree. The individual must be knowledgeable in the Early Ceramic period, preferably the Greenwood Phase.

c. Standards for Consultants. Personnel hired or subcontracted for their special knowledge and expertise must have academic and experimental qualifications in their own fields of competence.

d. Institutional or Corporation Qualification. The Contractor must provide, or demonstrate access to the following capabilities:

(1) Adequate permanent field and laboratory equipment necessary to conduct operations defined in the Scope of Work.

(2) Adequate laboratory and office space and facilities for the proper treatment, analysis, and storage of specimens and records obtained from the project. Specialized facilities such as pollen, geochemical, or radiological laboratories are not required.

4. Collections: The collections shall be stored in containers clearly marked "Property of the U.S. Government, Corps of Engineers, Kansas City District." These materials may be stored at the contracting firm's laboratories for use in future studies or at a repository agreed upon by the Corps, the Contractor, and the State Historic Preservation Officer. The U.S. Army Corps of Engineers reserves the right to retrieve these materials. If materials are to be removed from the agreed upon facilities, this action must be approved previously by the Contracting Officer or his representative.

5. Court Action: In the event of controversy or court challenge, the principal investigator(s) (that person(s) responsible for the validity of the material presented in the report) shall testify on behalf of the Government in support of the report findings.

6. Contracting Agency Responsibilities.

a. The Contractor shall conduct all necessary review of literature, governmental reports, and other sources of information in the depth required for a comprehensive coverage of the study. The Contractor shall accumulate, develop, and interpret all needed scientific and technological information and data.

b. The Government will provide the Contractor with available background maps, reports, remotely sensed data, and correspondence as needed and will provide support regarding suggestions on data sources, format of study outline and reports, and review of study progress.

7. Schedule of Work.

a. The Contractor shall pursue the study in a timely, workmanlike manner to meet the schedule specified. During the course of the study, the Contractor shall coordinate bimonthly with the Contracting Officer's Representative. In addition, the Contractor shall attend one meeting of The Western Ozarks Research Consortium to provide information to the other Contractors working in the Osage River basin.

b. Thirteen (13) copies of a draft of a report of findings, shall be submitted to the Contracting Officer for purposes of peer and Governmental review on or before 1 July 1977.

c. Thirty (30) days after return of the draft report by the Government, the Contractor shall submit an original of the final report of findings for reproduction by the Government. The Contractor will be given 10 copies of the report for his personal use. The report shall contain the following.

(1) An abstract and a brief narrative summary of the referenced literature and primary sources.

(2) A detailed discussion of each of the areas presented in the problem orientation concerning the Greenwood phase.

(3) Illustrations appropriate for the clarification or illustration of pertinent information.

d. The original of the final report, which shall be authored and signed by the principal investigator, shall be furnished in either one-and-one-half-spaced or double-spaced typing. The size of the pages and spacing of all margins shall be arranged for reproduction on 8- by 10-1/2 inch pages, except for foldouts. All text and illustrations must be of a quality suitable for reproduction.

c. If the project director is not the principal investigator, an abstract and review of the report authored by the project director shall be included as a preface to the report.

END

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